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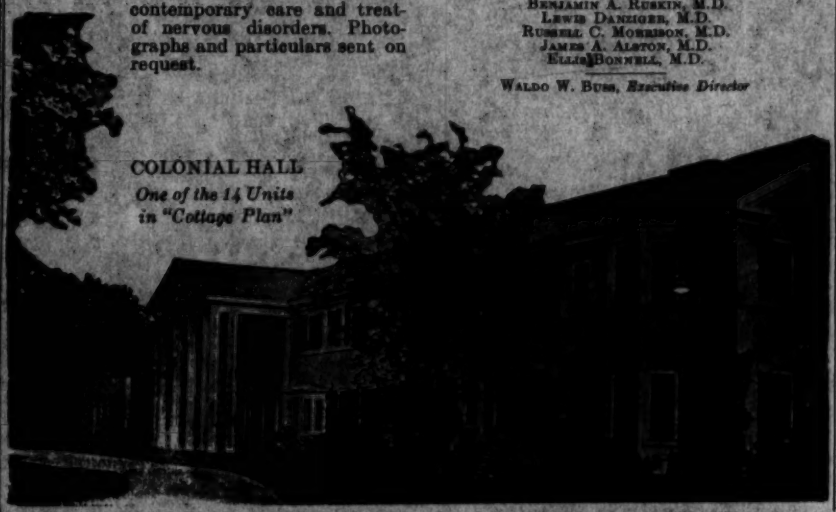

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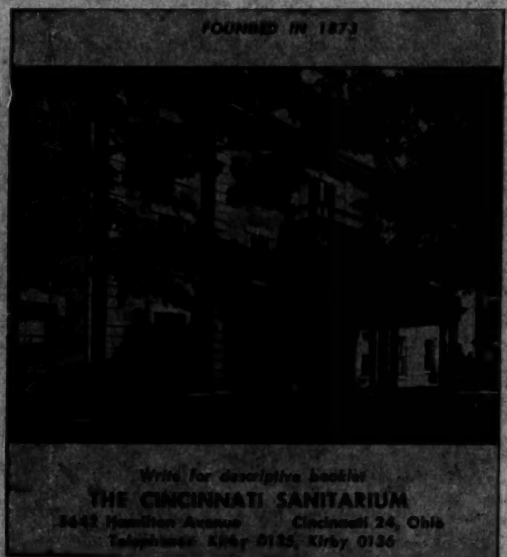

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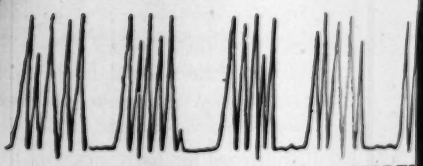

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Vol. 120, Nos. 3 and 4 SEPTEMBER - OCTOBER 1954 Serial Nos. 873 and 874

CLINICAL AND ELECTROENCEPHALOGRAPHIC STUDIES ON THE EFFECTS OF MESCALINE, N-ALLYLNORMORPHINE AND MORPHINE IN MAN [1, 2]

A Pharmacologic Analysis of the Functions of the Spontaneous Electrical Activity of the Cerebral Cortex

ABRAHAM WIKLER, M.D.

INTRODUCTION

Elsewhere (1) pharmacologic evidence has been adduced which seems to indicate that the spontaneous electrical activity of the cortex, as recorded under clinical conditions, is related to the activity of a neuronal system which, at least in part, is independent of those neuronal systems which subserve such functions as ideation, mood, consciousness and perhaps even motility and sensation. The purpose of the present study was to test this hypothesis and to obtain data which might permit some inferences concerning the possible functions of such a postulated independent neuronal system.

Investigation of the problem was facilitated by reports in the literature and incidental observations in this laboratory which indicated that a wide variety of clinical changes could be produced in man by a number of drugs which altered the electroencephalogram in a rather simple way, thus permitting ready analysis of records and correlation of changes in them with the clinical findings. Mescaline, N-allylnormorphine and morphine were selected for this purpose since by use of these three agents a broad spectrum of clinical effects could be observed.

[1] From the National Institute of Mental Health, National Institutes of Health, Public Health Service. Addiction Research Center, U. S. Public Health Service Hospital, Lexington, Kentucky.

[2] Read at the Sixth Annual Meeting of the American Electroencephalographic Society in Atlantic City, N. J., May 10, 1952.

The clinical effects of mescaline have been described by a number of authors, the most detailed reports being those of Stockings (2) and of Hoch (3). In general, their findings are quite similar. The outstanding effects of this drug in man are the production of hallucinations, illusions and distortion of space-perception in a setting of relatively intact sensorium. However, latent or overt psychotic trends may be underscored by the drug. The electroencephalographic changes which are produced by mescaline in man have been described by Chweitzer, Geblewicz and Liberson (4) who reported that alpha rhythms were blocked when the subjects experienced visual hallucinations. In a latter study by Rubin, Malamud and Hope (5) it was found that, in schizophrenic subjects, alpha frequencies were increased by mescaline.

N-allylnormorphine is a new synthetic derivative of morphine which antagonizes some of the depressant effects of morphine (6, 7). Isbell and Fraser (8) observed that former opiate addicts did not like the effects of N-allylnormorphine and that this agent intensified the morphine abstinence syndrome in man and prevented the relief of withdrawal phenomena by morphine. The clinical effects of N-allylnormorphine on former opiate addicts were also observed by Wikler (9) in an investigation which was preliminary to the present study. The electroencephalographic effects of N-allylnormorphine have not been described previously.

The clinical actions of morphine are well

known, although there are certain peculiarities in the effects of this agent on drug addicts (10, 11). Andrews (12) has described the effects of morphine on the electroencephalograms of post-addicts. Single doses (20 mg. subcutaneously) produced no changes in these subjects, but in one non-addict changes in the electroencephalogram were produced which resembled sleep, although the subject was wide awake. Scheider and Remond (13) reported that intravenous injection of morphine (amount not stated) accentuated previously-existing abnormalities in the electroencephalogram.

These studies were all concerned with general, over-all effects of drugs. As far as can be determined, no comparisons have been made of the transient as well as the more continuous clinical and electroencephalographic changes which may be observed after administration of mescaline, N-allylnormorphine or morphine in man. For the purpose of the present study, such comparisons were considered to be essential and the investigation was therefore designed accordingly.

Methods

Thirty-five combined clinical and electroencephalographic studies were made on 21 individuals who volunteered to serve as subjects. All subjects were white male prisoner patients at the U. S. Public Health Service Hospital with previous histories of drug addiction ("post-addicts"). Their ages ranged from about 25 to 53 years. Physical examinations prior to the experiments revealed no significant abnormalities. In all cases the diagnosis of "character disorder" or "psychopathic personality" had been made after admission to the institution. Detailed psychiatric examinations were not made in connection with the present study, but observations of the patients prior to medication revealed no evidence of psychosis or impairment of the sensorium.

Electroencephalograms were recorded by means of a 4- or 8-channel Grass ink-writing electroencephalograph in "push-pull" arrangement in a quiet room which was air-conditioned and electrically shielded. The room was darkened but enough light was admitted to permit close observation of the subjects. All recordings were made with the patient supine on a comfortable bed. Stainless steel, No. 30-gauge hypodermic needle electrodes were used for recording from the scalp in all experiments. (1) In all subjects, standard frontal, parietal, occipital, temporal and ear leads were employed. In addition, anterior temporal, vertex, cervical, tympanic and nasopharyngeal leads (1) were used in four experiments with mescaline and in four with morphine. Also, tremorgraphs (1) were recorded in four experiments with mescaline and in two experiments with N-allylnormorphine. When these were used, central (motor) electroencephalographic scalp leads were also inserted for concomitant recording with tremors or voluntary movements of the extremities. In all experiments both "bipolar" and "monopolar" records were made. In the latter instances, the interconnected ear leads were used as "reference" electrodes.

Mescaline was administered orally in fourteen experiments on 11 of the subjects. The initial dose in each case was 5 mg./kg. (285 to 500 mg.) of the drug, dissolved in about half a tumbler of water. In five of these experiments an additional dose of mescaline was administered by the same route 1 to 1½ hours after the first dose in attempts to enhance the effects of the drug.

N-allylnormorphine was administered by subcutaneous injection in ten experiments on 10 of the subjects. In all but one experiment only a single dose was given. This dose varied from 15 to 75 mg. In one experiment a total of 60 mg. was administered in three divided doses over a period of 114 minutes.

Morphine was administered intravenously in 11 experiments on 10 of the subjects. A standard dose of 30 mg. was employed in all cases.

In all experiments the procedure was as follows: While the necessary preparations of the patient for electroencephalography were under way, an attempt was made to allay any anxiety which might be present by friendly, informal conversation. After these were completed, the room was darkened and the subjects were asked to lie quietly with their eyes closed. Control electroencephalograms of 10 to 40 minutes' duration were then made and in some experiments there were also recorded the effects of flashlight beams directed toward the closed eyelids, opening and closing the eyes, silent

mental calculations, counting aloud, reciting verse familiar to the subjects (e.g. "America"), repeating unfamiliar nonsense words aloud (e.g. Lewis Carroll's "Jabberwocky") and tapping a finger rhythmically. The primary drug under investigation in each experiment was then administered as indicated above. Its nature was not revealed to the subject. After mescaline or N-allylnormorphine the subject was requested to report any change that he experienced. He was also observed carefully and short electroencephalographic records were made at intervals of 5 or 10 minutes. In the experiments in which morphine was the primary agent, the electroencephalograph was operated continuously from the time venipuncture was accomplished to about 5–8 minutes after completion of the injection. In all experiments, longer samples of the electroencephalogram were obtained after the subject reported a subjective change, or when objective changes were noted either clinically or in the electroencephalogram. Following each sample, the subject was interrogated regarding his subjective experiences and his neurological status was checked briefly. Some of the patients were encouraged to describe their subjective experiences aloud while electroencephalograms were being recorded. After medication, such records were made for about 1 to 5 hours, after which the subjects were dismissed, or the effects of other drugs were studied.

Following mescaline, the effects of intravenous injection of 3 to 5 cc. (300 to 500 mg.) of tetraethylammonium chloride ("Etamon") were studied in seven experiments, 20 to 30 mg. of morphine in five, and 0.1 to 0.3 gram of sodium pentothal, pentobarbital or amytal in seven, either singly or in succession. Following N-allylnormorphine, the effects of intravenous injection of 30 mg. of morphine were studied in five experiments, and 0.1 to 0.3 grams of pentobarbital in three, either singly or in succession. Following morphine as the primary agent, no other drugs were administered.

Further information was obtained by discussing with the subjects the next day their experiences while under the influence of the drugs administered during the experiments.

The electroencephalographic records were analyzed as follows: After inspection of the record as a whole, representative samples consisting of 1- to 5-minute continuous tracings were selected from the control portions and from each of the subsequent runs. The tabular material in tables 1 and 2 are based on such "representative" samples. Mean alpha frequencies were calculated by averaging the duration of approximately ten series of three waves each in the 8 to 13 cycles per second. The percentage of time the record was occupied by rhythms of three or more successive alpha waves (referred to as "alpha percentage" in this paper) was estimated by underlining such rhythms and then comparing the sum of their durations with the length of record analyzed. For estimation of mean alpha frequency and alpha percentage, occipital monopolar records were generally used; parietal tracings were used in a few instances in which the occipital tracings were technically unsatisfactory.

For descriptive purposes (see table 1) each sample was classified as follows: L, M and H designate records in which alpha rhythms with frequencies between 9 and 11 cycles per second occupied less than 35 per cent, 35 to 70 per cent and over 70 per cent of the sample respectively. In records so designated, alpha rhythms alternated chiefly with non-rhythmic waves of moderate voltage (approximately that of the alpha rhythms) and of variable frequencies. LF, MF and HF designate corresponding records in which alpha frequencies were between 11 and 12 cycles per second, while similarly, LS, MS and HS refer to records in which alpha frequencies were between 7 and 9 cycles per second. DC (desynchronization, continuous) designates records in which alpha rhythms were low (0 to 35 per cent) and in which the predominant activity consisted of non-rhythmic low-voltage fast waves. DI (desynchronization, intermittent) refers to records in which alpha rhythms (over 35 per cent) alternated with low-voltage fast activity. D-SL (desynchronization and slow activity) indicates records in which non-rhythmic low voltage fast activity predominated, but in which random moderate-voltage slow waves (3 to 7 cycles per second) occurred infrequently. SY-SL (synchronization and slow activity) pertains to records consisting almost

TABLE 1.—WIKLER, A.: CLINICAL AND ELECTROENCEPHALOGRAPHIC EFFECTS OF MESCALINE, N-ALLYLNORMORPHINE AND MORPHINE IN MAN.

Clinical Observations	*Electronencephalographic Patterns*												
	DC	DI	D-SL	LF	MF	HF	L	M	H	LS	MS	HS	SY-S
Control							5	12	18				
Anxiety—moderate	z	z	y		z		zzz	yy zz	y zz			y	
Anxiety—marked	y							z					
Anxiety with Fantasies	y							y			y		
Anxiety with Fantasies and drowsiness	y												
Anxiety with drowsiness			y					y					
Anxiety with illusions and tremors						z							
Anxiety with tremors	zz					z							
Anxiety with hallucinations		zzz			z		z	z					
Hallucinations		zzz							zz				
Hallucinations with illusions									z				
Fantasies			y				y						
Fantasies with relaxation and drowsiness			y									y	y
Fantasies with relaxation			y										
Tremors		z					z						
"Thrill"								xxx	xxx				
Euphoria with relaxation			x					xx	xxxx xxx		xx	x	
Relaxation		y						zz			y		
Drowsiness			xx y										

x, morphine; y, N-allylnormorphine; z, mescaline. See text for explanation of EEG symbols.

entirely of rhythmic activity (alpha rhythms and rhythms with frequencies over 13 cycles per second) and considerable admixtures of random and rhythmic slow waves (3 to 6 cycles per second).

For purposes of classifying directional changes in the electroencephalograms (table 2), additional designations were as follows: NC (no change) refers to records in which no significant changes from the last previous sample (control or after drugs) were observed. F (fast) and S (slow) refer respectively to records in which no significant changes in alpha percentage were observed but in which mean alpha frequencies were decreased or increased respectively by at least 1 cycle per second. SY (synchronization) refers to records in which alpha percentage was increased in comparison with the last previous sample to a sufficient degree to warrant a change in its classification from L to M or from M to H.

In order to minimize subjective bias in selecting "representative" samples of electroencephalograms, each record was submitted to the following analytic procedure. After "representative" samples were selected, the re-

TABLE 2.—WIKLER, A: CLINICAL AND ELECTROENCEPHALOGRAPHIC EFFECTS OF MESCALINE, N-ALLYLNORMORPHINE AND MORPHINE IN MAN.

Clinical Changes (Directional Increase)	*Direction of Change in EEG Pattern*							
	Desynchronized					*Synchronized*		
	DC	DI	D-SL	F	NC	SL	SY	SY-SL
Anxiety—moderate	z	z	y	z	yyy zzzzzz		y	
Anxiety—marked	y				z			
Anxiety with fantasies	y				y			y
Anxiety with fantasies and drowsiness	y							
Anxiety with drowsiness			y				y	
Anxiety with illusions and tremors				z				
Anxiety with tremors	zz			z				
Anxiety with hallucinations		zzz		z	zzz			
Hallucinations		zzz			zz			
Hallucinations with illusions					z			
Fantasies			y		y			
Fantasies with relaxation and drowsiness			yy					
Fantasies with relaxation			y			y		
Tremors					z			
"Thrill"					xxxxx		x	
Euphoria with relaxation			x		xxx	xx	xxxxxx	x
Relaxation		y						y
Drowsiness			y xx					

x, morphine; y, N-allylnormorphine; z, mescaline. See text for explanation of EEG symbols.

mainder of the record was analyzed as indicated above. From the representative samples, strips were then selected for illustration and both of these analyzed separately in random order. With few exceptions the classification of records and estimation of mean alpha frequencies were essentially the same in all three groups. Where discrepancies were found, new "representative" samples were obtained and the analytic procedure was repeated until agreement in all three groups was obtained.

RESULTS

The control electroencephalograms in all subjects were within statistically "normal limits and were classified as indicated in table 1. Opening the eyes was accompanied by an immediate disappearance of alpha rhythms in the electroencephalograms[2] and the latter consisted almost entirely of non-rhythmic low voltage fast activity. This change persisted until the eyes were closed again, when alpha

[2] Descriptions of changes in electroencephalograms in this study are based mainly on those which appeared in the central, parietal and occipital tracings. The records obtained from naso-pharyngeal and tympanic leads differed in no significant way from the frontal and temporal tracings and such changes as occurred in these were in the same direction as those which were observed in the central, parietal and occipital tracings.

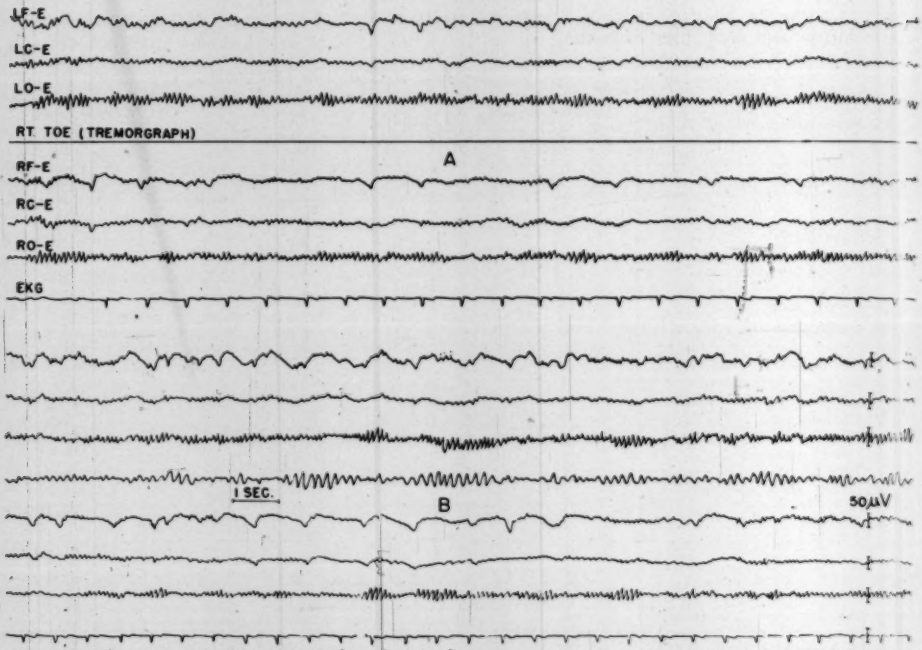

FIG. 1. Subject no. 10. 8-2-23-51. Left and right frontal, central and occipital "monopolar" EEG tracings, tremorgraphs or right toe and EKG. A, control. Note high alpha percentage, alpha frequencies 9-10 cps. Cardiac rate 66 per minute. No tremors. B, 72 minutes after oral administration of 500 mg. of mescaline (5 mg./kg.). Moderate anxiety. No hallucinations. Alpha percenta still high, but alpha frequencies 10-11 cps., with slight reduction in voltage. Cardiac rate 90 per minute. Periodic tremors at rest (reduced on voluntary innervation), frequency about 6 cps. Note absence of correlation between tremor and EEG pattern.

rhythms reappeared. Directing a beam of light from a battery-operated flashlight against the closed eyelids resulted in similar changes (fig. 3, 6). However, alpha rhythms reappeared if the light flash was maintained longer than 5 to 15 seconds. Silent mental calculation (subtracting 3 from every other number from 100 backward) was accompanied by either no change in the electroencephalogram or in a moderate reduction in voltage and percentage of alpha rhythms. Reciting familiar or unfamiliar verse and tapping an index finger rhythmically were not accompanied by significant changes in the electroencephalogram (fig. 7).

Mescaline. In general, the administration of mescaline was followed by the development of anxiety, visual hallucinations, illusions, some distortion of spatial perception, tremors, hyperactivity of tendon reflexes with occasional unsustained ankle or patellar clonus, mydriasis, tachycardia and sweating. A few patients were also nauseated and vomited. However, there was considerable variation in response patterns.

Anxiety was generally the first change which was observed and occurred in 10 of the 14 experiments. The onset of anxiety varied from approximately 27 to 100 minutes after administration of mescaline. The presence of a moderate degree of anxiety was inferred when the patient reported " I feel nervous" or "jittery" or "jumpy", etc. Marked anxiety was considered to be present when, in addition to such comments, subjects exclaimed "I can't stand this" or "Get me out of here" or "Get this stuff out of me", etc. Such anxiety states were accompanied by varied electroencephalographic patterns (table 1), but changes in the electroencephalogram from the control pattern were in the direction of desynchronization or increase in the frequency of alpha rhythms (fig. 1, table 2). However, such changes were

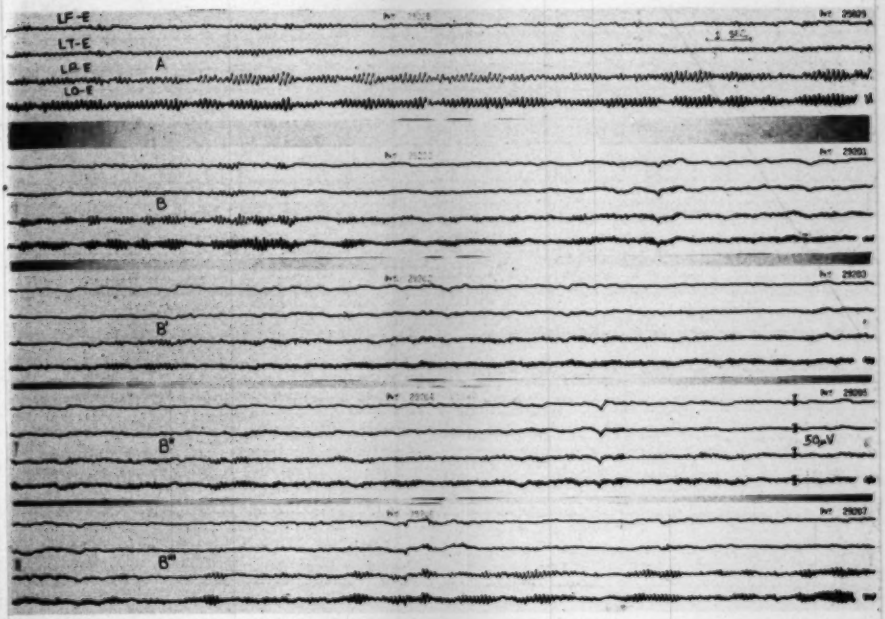

FIG. 2. Subject no. 6. 2-9-50. Left frontal, temporal, parietal and occipital "monopolar" tracings. A, control. Note high alpha percentage, alpha frequency 9 cps. B, B′, B″ and B‴, continuous record 17 minutes after oral administration of 700 mg. of mescaline (10 mg./kg.) over a period of 110 minutes. Not anxious. Intermittent vivid visual hallucinations—during B, "blue, white and brown neon signs"; during B′, " a house with snow"; during B″, "aroows shooting through the air". Note alpha frequency 11 cps., alpha voltage and percentage sharply reduced, with predominance of low-voltage fast activity. These changes coincided with verbal reports of hallucinations. During B‴, subject experienced no hallucinations. Note moderately high alpha voltage and percentage, alpha frequencies 10.5-11.0 cps.

observed in only half of the samples analyzed. In the remainder, the development of anxiety was not accompanied by any significant change in the electroencephalogram. Although the procedure did not permit psychodynamic investigations, the anxiety states which were induced by mescaline appeared to be diffuse and not related topically to any particular event or experience. Occasionally the subjects expressed concern about hallucinations or tremors, but this was unusual. In three of the experiments, the subjects reported no "nervousness" and seemed to be unconcerned about other symptoms. In one experiment the subject appeared to enjoy his hallucinations and laughed occasionally.

Hallucinations occurred in eight of the experiments following administration of mescaline and they were always visual. The onset of hallucinations was somewhat later than that of anxiety, although in one instance hallucinations preceded anxiety. The hallucinations consisted of bright lights—white, red, blue, green or brown, sometimes in geometric designs or "neon lights"—insects, animals, statues, houses, snow, arrows shooting through the air, and similar impersonal images. Occasionally, human figures were visualized, such as "a man sweeping the streets". Significantly, in every case, the visual hallucinations disappeared when the eyes were opened. With the eyes closed, the hallucinations appeared irregularly for a few seconds at a time. Of twelve electroencephalographic samples which were recorded when hallucinations were experienced, no significant change in pattern was observed in five, while in six, intermittent desynchronization occurred concomitantly with verbal reports of hallucinations (fig. 2) and in one, alpha frequencies were accelerated (table 2).

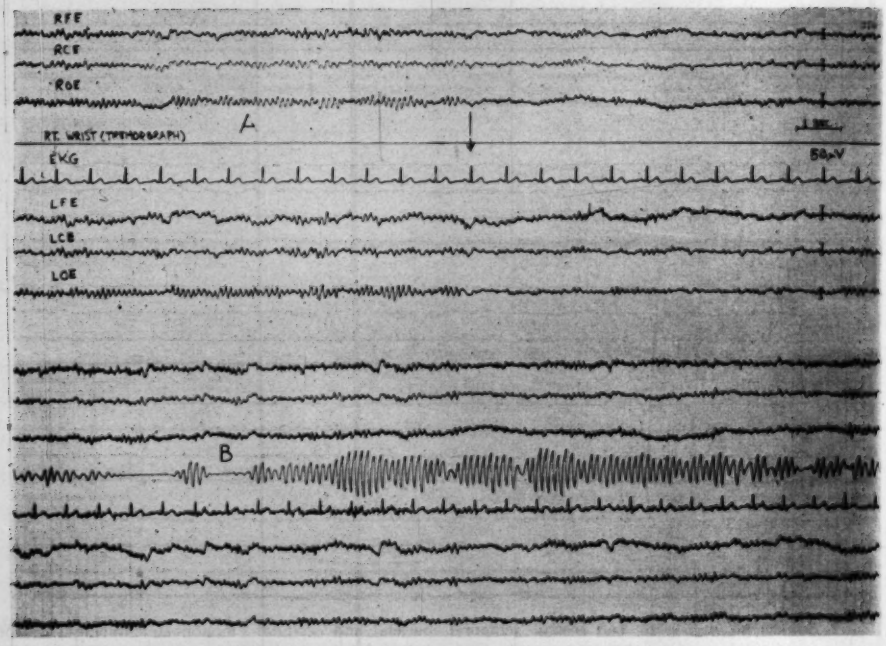

FIG. 3. Subject no. 9. 8-28-51. Right and left frontal, central and occipital "monopolar" EEG tracings, tremorgraph (right wrist) and EKG. A, control. Note high alpha percentage, alpha frequencies 8-8.5 cps. Cardiac rate 76 per minute. At arrow, light-flash was directed against closed eyelids and was maintained during rest of sample. Note marked reduction in voltage and rhythmicity with predominance of low voltage fast activity. (Immediately after termination of light-flash EEG returned to previous pattern.) B, 110 minutes after oral administration of 575 mg. of mescaline (7.7 mg./kg.) over a period of 70 minutes. Marked anxiety and tremors at rest in both upper extremeties (tremors reduced during voluntary intention movements of same). Mydriasis, sweating and hyeractivity of tendon reflexes were also noted. No hallucinations. Cardiac rate 90 per minute. Note predominance of low voltage fast activity with occasional brief 8-9 cps. alpha rhythms (record somewhat blurred by muscle artifact background) in EEG, the pattern of which resembles that of control (A) during light flash. Tremor frequencies 6-7 per minute. No apparent correlation between tremor and EEG patterns.

Apparently such intermittent desynchronizations were related to the visual hallucinations rather than to the act of talking aloud since, as noted above, control studies showed that merely talking aloud did not alter the electroencephalogram significantly, even when this was associated with some degree of attention (repeating "Jabberwocky" aloud after the instructor). In three of the experiments in which hallucinations occurred, anxiety was also present. In general, the degree of anxiety which occurred concomitantly with hallucinations was not as intense as that which was observed when hallucinations did not develop after mescaline.

Tremors developed after the administration of mescaline in eight experiments. These were later in onset (40 to 156 minutes) after medication than anxiety or hallucinations. The tremors were "coarse" and generally appeared first in one extremity, then shifted to another and involved both upper, both lower or all four extremities simultaneously. In one experiment, head tremors occurred concomitantly with tremors in both upper extremities. On tremorgraphs which recorded joint movements, the tremors exhibited sinusoidal rhythmicity and their frequencies varied from about 4 to 13 cycles per second. However, in most instances the tremor frequencies were between 6 and 8 cycles per second. The tremors appeared at rest and were definitely reduced in magnitude when voluntary intention move-

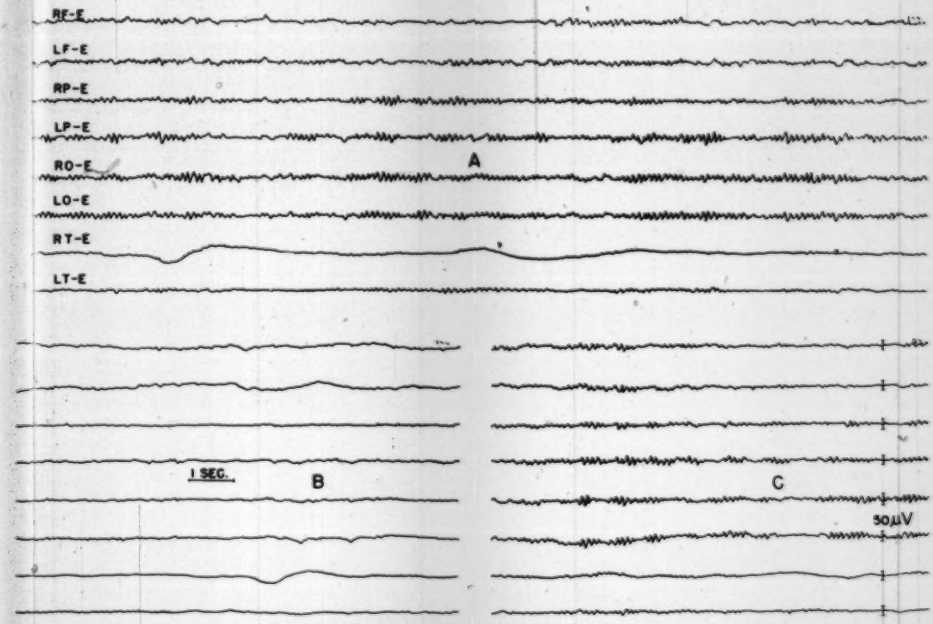

FIG. 4. Subject no. 16. 12-26-50. Right and left frontal, parietal, occipital and temporal "monopolar" tracings. A, control. Note high alpha percentage, alpha frequencies 8-5-9-5 cps. B, 30 minutes after subcutaneous injection of 60 mg. of N-allylnormorphine. Intense anxiety. Vivid unpleasant fantasies (daydreams). Note marked reduction in voltage and complete absence of rhythmic activity in EEG. Sample is representative of entire record until after injection of morphine. C, 60 minutes after 30 mg. of morphine which was injected intravenously 70 minutes after N-allylnormorphine. Anxiety undiminished but no fantasies. Note return of EEG to approximate control pattern with moderately high alpha percentage and alpha frequencies 8.5-9.5 cps.

ments of the affected extremity were executed (e.g., on the "finger-to-nose" test). However, the tremor pattern was simple, consisting of alternate flexion and extension and/or supination and pronation. No "pill-rolling" patterns were observed. In five electroencephalographic samples which were recorded during the presence of tremors, no change was observed in the electroencephalographic pattern in one experiment, while in the others the pattern shifted in the direction of desynchronization (table 2). However, in these four cases, anxiety, anxiety with hallucinations or anxiety with illusions occurred concomitantly. In no case was a correlation observed between exacerbation or subsidence of tremors and appearance or disappearance of alpha rhythms or other activity in the electroencephalogram (fig. 3).

Illusions occurred in one experiment after mescaline. When his eyes were open, this subject noted a shadow on the wall and stated that it seemed to shift up and down like a "venetian blind or shutter being opened and closed". Concomitantly he also displayed a moderate degree of anxiety and, in comparison with his control record, alpha frequencies were accelerated in the electroencephalogram (by about 1 to 1½ cycles per second).

Mydriasis, tachycardia, sweating and hyperactivity of tendon reflexes occurred in about half of the subjects, but these changes were not always concomitant with each other, nor with anxiety and/or hallucinations. In one experiment, spatial perception appeared to be distorted after mescaline. This subject stated that objects appeared to vary in size and shape, while at times the walls of the room appeared to be slanting.

In all experiments with mescaline described here, contact and insight were not impaired.

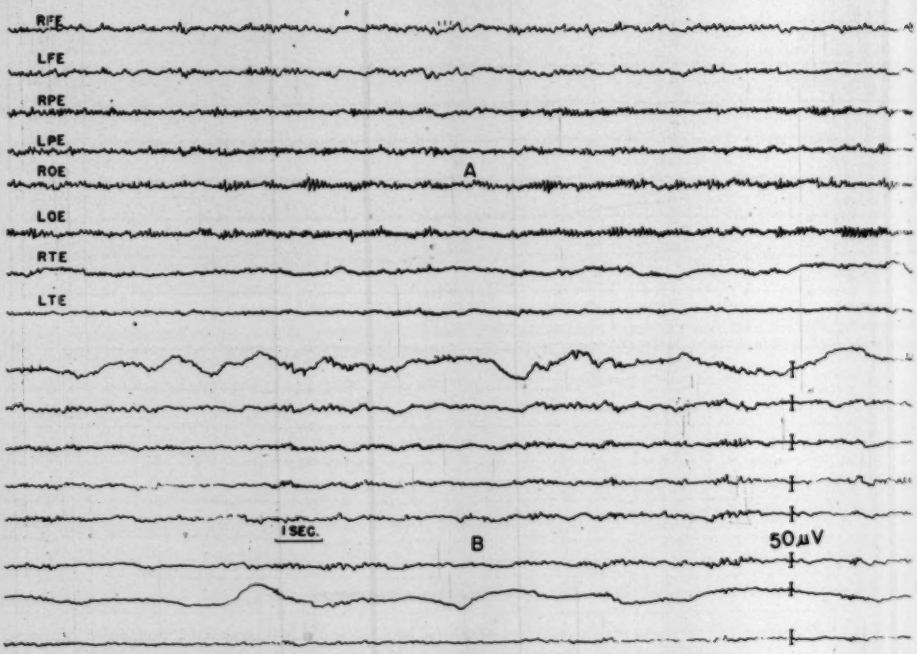

FIG. 5. Subject no. 14. 12-28-50. Right and left frontal, parietal, occipital and temporal tracings. A, control. Note high alpha percentage, alpha frequencies about 11 cps. B, 42 minutes after subcutaneous injection of 60 mg. of N-allylnormorphine. Moderate anxiety. No daydreams. Note predominance of low-voltage fast activity with few moderate-voltage 7 and 21 cps. rhythms of brief duration.

The subjects remained well-oriented for person, place and time, responded relevantly to questions and were fully aware of the fact that their subjective experiences, including hallucinations, were "unreal". It may be mentioned, however, that in exploratory studies which are not included in this report, a syndrome—which resembled paranoid schizophrenia strikingly—appeared after mescaline in one subject who was not previously psychotic, but whose responses in a Rorschach test prior to administration of the drug suggested this diagnosis.

In the subjects who developed anxiety with or without other changes after administration of mescaline, the effects of subsequent administration of other drugs were also investigated. Intravenous injection of 20 to 30 mg. of morphine produced miosis but only transient relief of anxiety for a period of 5 to 10 minutes. Later, anxiety, hallucinations and tremors reappeared, if they were present before injection of morphine. Intravenous injection of tetraethylammonium chloride ("Etamon") in amounts just sufficient to produce fixation of the pupils, abolition of sweating and tachycardia (3 to 5 cc.) had no effect on the subjective changes produced by mescaline, or on tremors. Intravenous injection of barbiturates (0.1 to 0.3 gram) was most effective in abolishing the clinical changes produced by mescaline. Anxiety was promptly relieved and was replaced by euphoria. Hallucinations were also promptly abolished. Tremors were abolished temporarily but returned later. Subjects who had displayed anxiety and tremors prior to administration of barbiturates observed their tremors with curiosity but without apprehension after such medication. The effects of barbiturates generally wore off after 2 to 3 hours but repeated doses of these agents were again successful.

N-allylnormorphine. The intensity of the effects of N-allylnormorphine were roughly proportional to the dose but in general this

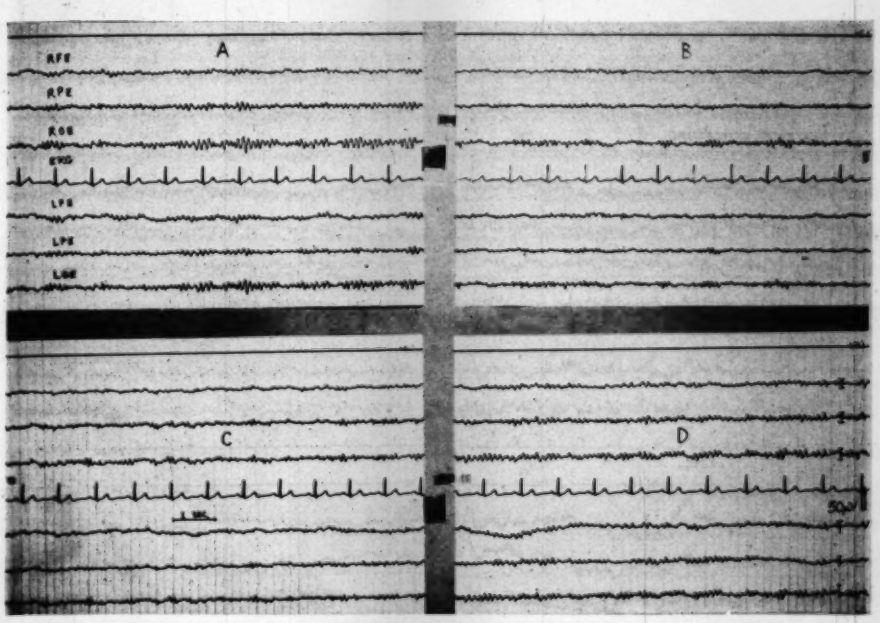

FIG. 6. Subject no. 17. 8-21-51. Right and left frontal, parietal and occipital "monopolar" EEG tracings and EKG. A, control. Note moderately high alpha percentage, alpha frequencies 9-10 cps. Cardiac rate 66 per minute. B, immediately after and during single light-flash directed against closed eyelids. Note marked reduction in voltage and rhythmicity with predominance of low-voltage fast activity. (Immediately after termination light-flash EEG pattern returned to that of A.) C, 16 minutes after subcutaneous injection of 15 mg. of N-allylnormorphine. "Floating", with fantasies. Not anxious. Note similarity of EEG pattern to that of B. (This pattern alternated at times with that of A.) D, 68 minutes after injection. Relaxed, no fantasies. Note return of alpha rhythms which are slightly slower (8-9 cps.) than in A.

agent produced anxiety, a peculiar dreamy state with vivid fantasies, miosis, pseudoptosis, sweating and diuresis. Occasionally the effects were rather pleasant and relaxation occurred. After 60 to 75 mg. of the drug bradycardia was usually observed. Some of the subjects stated that their limbs felt heavy and "numb" but no corresponding alterations in muscle strength, reflexes or sensory perception could be demonstrated objectively. A few subjects stated that when their eyes were closed they felt as if someone were pulling their extremities.

Anxiety developed in seven of the ten experiments with N-allylnormorphine, and was expressed by the subjects in terms similar to those noted after mescaline. Such anxiety was usually associated with vivid fantasies or daydreaming but when anxiety was marked the subjects reported few or no daydreams. The most intense anxiety was displayed by one subject who received 60 mg. of N-allylnormorphine. He insisted that the experiment must be terminated immediately and threatened to pull the electrodes out if relief was not afforded. He was unable, or refused to elaborate on the nature or source of his anxiety but perhaps significantly it was known that he had been charged with murder at one time and was unusually taciturn and hostile. All of the anxious subjects displayed evidence of irritability. They appeared to resent questioning or examination and reported that "This stuff makes you feel mean." Concomitantly with the development of anxiety, the electroencephalographic patterns remained unaltered in 4 of the 12 samples, shifted in the direction of desynchronization (figs. 4 and 5) in five and synchronization in three. Euphoria did not develop in any of the subjects but two, who were

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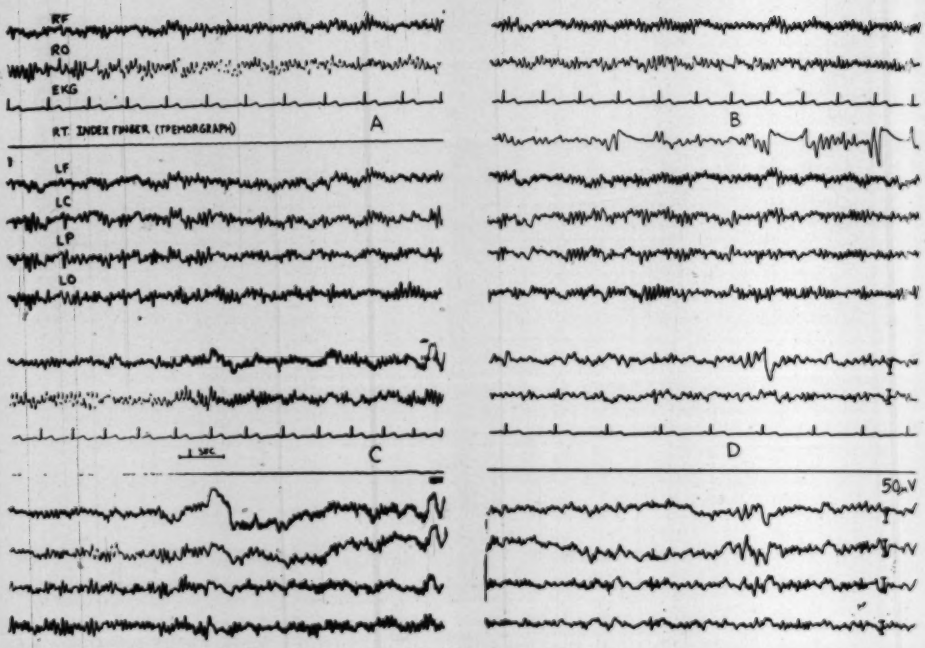

FIG. 7. Subject no. 11. 8-30-51. Right frontal and occipital, left frontal, centarl, parietal and occipital "monopolar" EEG tracings, EKG and tremorgraph records of voluntary movements of right index finger. A, control. Note moderately high alpha percentage, alpha frequencies above 10 cps. Cardiac rate 72 per minute. B, while tapping right index finger rhythmically. Note absence of significant change in EEG. C, while repeating "Jabberwocky" aloud after instructor. Note absence of significant change in EEG (slow base-line swings are artifacts associated with respirations). D, 67 minutes after subcutaneous injection of 60 mg. of N-allylnormorphine over a period of 114 minutes. Relaxation, drowsiness and fantasies (daydreaming). No anxiety. Note moderate-voltage 12 cps. ryhthms alternating with high-voltage 3-4 cps. rhythms. Cardiac rate 54 per minute.

given 60 mg. of the drug, thought the effects were rather pleasant.

Daydreaming with fantasies appeared in eight experiments after N-allylnormorphine. The subjects reported that thoughts kept "racing" through their heads and that they seemed to be dreaming at times about events in childhood or that they were "imagining" that they were playing baseball, looking at houses or calling on a girl friend. It appeared that these reported fantasies were not related to such anxiety as was present and it was suspected, although not proven, that the subjects consciously avoided reporting fantasies which they regarded as unacceptable. Most of the subjects also reported that they felt drowsy but couldn't fall asleep because of the daydreams and their general irritability. However, one subject stated that he felt "relaxed" and two others that they were both relaxed and drowsy, although all three were experiencing fantasies at the time these reports were made. In ten electroencephalographic samples which were taken while the subjects reported fantasies or daydreaming, a change in the direction of desynchronization occurred in six, synchronization in two, slowing of alpha frequencies (by 1 cycle per second) in one, while in another the pattern was not altered (figs. 6–9).

In the subjects who developed anxiety, the effects of morphine and/or barbiturates were also investigated. Intravenous injection of 20 to 30 mg. of morphine alleviated anxiety only slightly. Intravenous injection of 0.1 to 0.3 gram of one of the barbiturates was far more

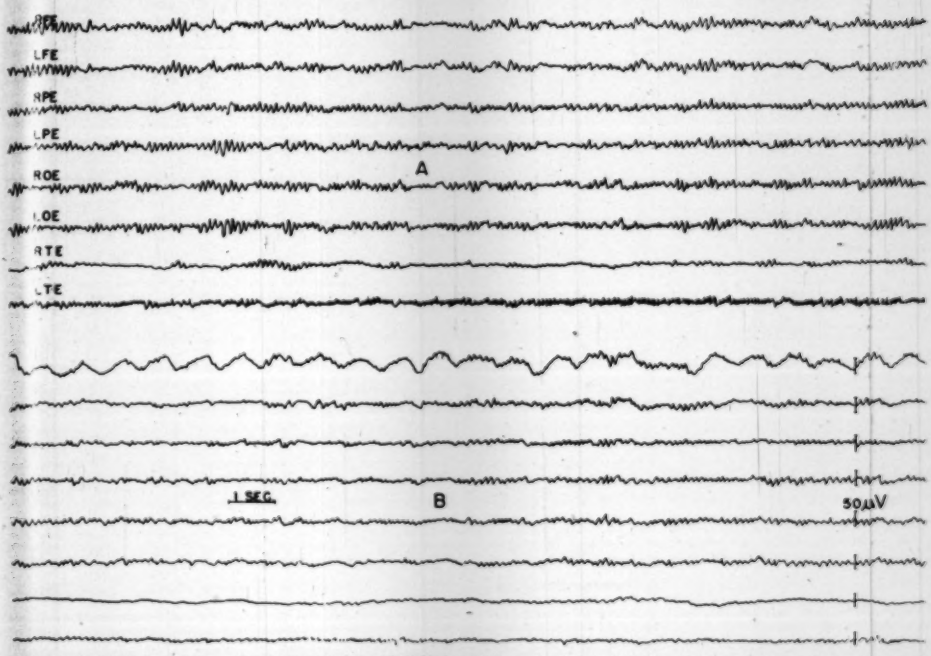

FIG. 8. Subject no. 15. 12-26-50. Right and left frontal, parietal, occipital and temporal tracings. A, control. Note high alpha percentage, alpha frequencies 9-9.5 cps. B, 40 minutes after subcutaneous injection of 30 mg. of N-allylnormorphine. Not anxious. Relaxed. Daydreaming about ballgrounds. Note low-voltage non-rhythmic activity alternating with moderate-voltage 7.5-8.5 cps. rhythms in EEG.

effective although, in some instances, repeated injections were necessary.

Morphine. The clinical effects of morphine were very uniform in all eleven experiments in which this agent was the first drug administered. Within one minute after intravenous injection, the skin became flushed and the subjects reported that they experienced an extremely pleasurable "thrill" which lasted 2 to 5 minutes. This "thrill" is a sensation which is almost universally experienced by narcotic addicts after intravenous injection of morphine and it constitutes one of the most desirable effects of the drug for them. It is generally described as a tingling sensation "all over" which is accompanied by an experience akin to orgasm except that it is centered in the "stomach" instead of the genitals. It is usually accompanied by itching and not infrequently by vomiting, but addicts regard these accompaniments as pleasurable. All subjects in this study experienced such a "thrill" immediately after intravenous injection of morphine. They also stated that they felt more wide awake than before injection and this seemed to be confirmed by clinical observation. In six electroencephalographic samples which were recorded while the "thrill" and arousal were experienced, no change in pattern occurred in five while (fig. 10) in one there was a change in the direction of synchronization.

After subsidence of the "thrill", all of the subjects except one reported that they were "fixed" (euphoria), "coasting (relaxation) and/or "on the nod" (drowsiness). In 15 electroencephalographic samples which were recorded while such changes occurred, the pattern changed in the direction of synchronization in nine (fig. 10), and desynchronization in three, while in three no change was observed. In one experiment the subject reported that after the initial "thrill" he felt uneasy and kept wondering what the nature of the drug was. In this individual the electro-

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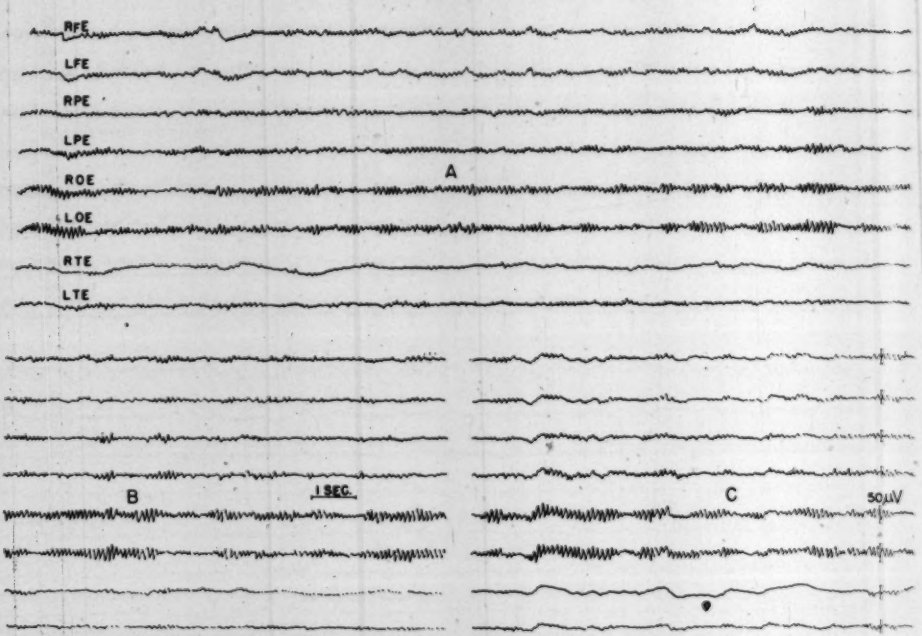

FIG. 9. Subject no. 20. 12-27-50. Right and left frontal, parietal, occipital and temporal "monopolar" tracings. A, control. Note high alpha percentage, alpha frequencies 10.10.5 cps. B, 30 minutes after subcutaneous injection of 60 mg. of N-allylnormorphine. Irritable, but not daydreaming. No change in EEG. C, 60 minutes after injection. Daydreaming, but no change in EEG.

encephalogram showed no change from the control pattern after injection of morphine. Significantly, this individual had served as a subject in a mescaline experiment one week previously and at that time he experienced rather marked anxiety. The day after the morphine experiment he reported spontaneously that after he was dismissed from the electroencephalograph room he returned to the Research ward, felt much better and decided that he had been given morphine. He added that "I must have been scared because I thought you were giving me the same stuff I got last week."

DISCUSSION

It should be pointed out that the subjects who were used in this study constituted a highly selected group (post-addicts) and that to some extent this is reflected in the changes which were observed after administration of drugs. Thus, the uniformity of the clinical changes produced in these subjects after administration of morphine is what may be expected in a group of this sort and may not be observed in other types of subjects. Indeed, in this laboratory, a wide variety of morphine effects have been observed in non-addict subjects, particularly with regard to changes in mood and in level of consciousness. Some non-addicts experience euphoria, others become depressed, anxious or irritable after administration of morphine. Again, some non-addicts remain sufficiently wide-awake to be able to continue their work, while others find sleep irresistible after 15 mg. of morphine. However, the clinical changes which were observed in the present study after administration of mescaline were quite similar to those described by Hoch (3) in non-addict subjects. Likewise, the clinical effects of N-allylnormorphine in post-addicts appear to be of the same general nature as those noted by Isbell (14) in non-addicts.

Furthermore, it is apparent from the data

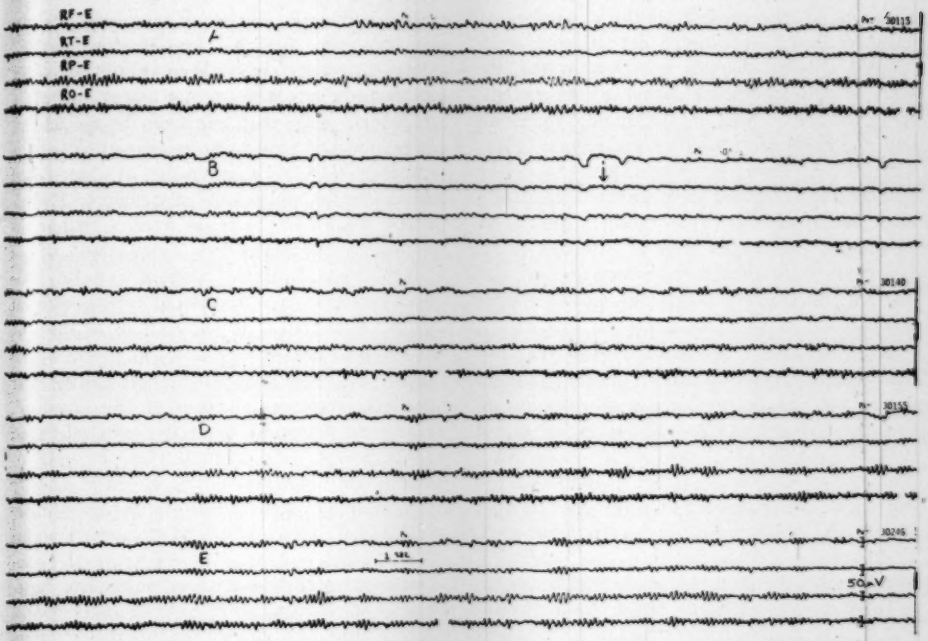

FIG. 10. Subject no. 5. 2-13-50. Right frontal, temporal, parietal and occipital "monopolar" tracings. A, control. Note moderately high alpha percentage, alpha frequencies 10-10.5 cps. B, following veni-puncture, just prior to start of injection of morphine (at arrow). Note marked lowering of alpha voltage and percentage with predominance of low-voltage fast activity just prior (anticipatory) to injection of morphine. C, 30 seconds after completion of injection of 30 mg. of morphine intravenously. Beginning to experience "thrill". EEG pattern similar to B. D, 200 seconds after completion of injection. Experiencing very pleasant "thrill", skin flushed, itching. Relaxed and euphoric. Note marked increase in alpha percentage, alpha frequencies 9.0-9.5 cps.

presented here that although the clinical effects of mescaline, N-allylnormorphine and morphine are fairly predictable in post-addicts statistically, this is not always true in any given individual. Apparently, factors other than the chemical properties of the drugs contributed to the effects which were observed. That the "personality" of the individual determined in part his reaction to these drugs appears to be probable, but it is noteworthy that of two subjects who were used in both mescaline and N-allylnormorphine studies, one displayed no evidence of anxiety in either test, while the other was extremely anxious after mescaline but regarded the effects of N-allylnormorphine (60 mg.) as "rather pleasant". That the previous history of the individual and the meaning of the experimental situation to him contributed to the effects of the drug administered is well illustrated by the reactions of the subject in whom the effects of intravenous injection of morphine were studied after a similar study one week previously on the effects of mescaline (see above). In this connection it may be noted here that even in post-addicts some of the effects of morphine appear to be determined in part by the circumstances under which the drug is administered. Thus, when morphine is administered under experimental conditions to a post-addict with assigned duties on the ward, he may display unusual energy in completing his tasks (polishing brass, mopping floors, etc.) and then proceed to bed where he will remain semisomnolent until assigned another task. The electroencephalographic changes which occurred after administration of mescaline in post-addicts were, in general, similar to those observed in non-addicts (4, 5).

However, in the present studies a number of instances have been pointed out in which well-marked clinical changes occurred in the absence of any significant change in the electroencephalogram. Similar dissociations occurred less commonly after N-allylnormorphine. Likewise, clinical changes without alteration of the electroencephalograms were observed frequently after administration of morphine. This is in agreement with the findings of Andrews (12). However, in the present study concomitant clinical and electroencephalographic changes were noted in more than half of the records.

Study of table 1 and 2 reveals that the electroencephalographic pattern, or the changes therein, cannot be predicted with certainty on the basis of knowledge *only* of the chemical properties of the drugs used in this study. Also, it is evident that well defined clinical changes can occur in the absence of significant changes in the electroencephalogram, at least within the limits of error determined by the analytical techniques utilized in this study. However, in no instance was a change noted in the electroencephalogram without concomitant clinical changes.

In general, regardless of the drug administered, when changes in the electroencephalogram occurred which were in the direction of "desynchronization", they were accompanied by clinical changes which could reasonably be regarded as involving increased cortical activity (anxiety, fantasies, hallucinations, tremors). When changes in the electroencephalogram occurred which were in the direction of "synchronization", the concomitant clinical changes were, with some exceptions, such as could be expected to be associated with diminished cortical activity (relaxation, drowsiness). Furthermore, it should be noted that the electroencephalographic changes, when they occurred, were diffuse, bilateral and non-specific in contrast to the rather complex and highly specific clinical changes which accompanied them.

Even more marked dissociations between electroencephalographic patterns and behavior are not infrequently observed clinically, and can be demonstrated experimentally. Thus, electroencephalographic patterns consisting chiefly of high voltage delta activity may be observed in patients who are actively addicted to methadone, or in others after insulin or electro-shock therapy, and who are neither drowsy nor asleep. Typical "spindle-slow wave" "sleep" patterns have been observed after morphine in rats who are not asleep and after atropine in dogs that, far from being asleep, are excited and have to be restrained to permit recording (15). Conversely, it has been shown that by appropriate placements of electrolytic lesions in the brain stem, a change in the electroencephalogram from that of a "sleep" to a "waking" pattern can be produced by stimulation of afferent nerves, without significant alteration in the somnolent state of the animal (16).

Such evidence suggests the possibility that the alpha and beta rhythms of the "resting" electroencephalogram, as well as the shifts in pattern toward desynchronization or synchronization are reflections of the electrical activity of a neuron system which is partially independent of "behavior-related" neuron systems (those which subserve ideation, mood, consciousness, motility and sensation). The functions of this hypothesized partially independent neuron system are homeostatic in that it alters the electrical fields in the cerebral cortex in the direction of desynchronization (irregular low voltage changes in electric fields) when the activity of "behavior-related" neuron systems tends to become excessive, and in the direction of synchronization (high voltage rhythmic changes in electrical fields) when the activity of "behavior-related" neuron systems tends to become markedly reduced.

That desynchronization of the electroencephalogram tends to reduce the activity of "behavior-related" neurons while synchronization produces effects in the opposite direction is suggested by certain observations which were made in the present study and other data in the literature. Thus, visual hallucinations which were experienced by the subjects after mescaline disappeared promptly when the eyes were opened, with concomitant complete and continuous desynchronization of the electroencephalogram. Conversely, visual hallucinations can be induced by *flickering* light stimuli at a frequency approximating that of the alpha rhythm in subjects who had received doses of mescaline which were insufficient to induce hallucinations in the absence of *rhythmic* photic stimulation (17). Also, it is well known that

sleep is associated with increased synchronization of the electroencephalogram and that many epileptics have seizures only, or more often, during sleep. Likewise, subconvulsive doses of morphine, which produce the typical electroencephalographic hypersynchrony associated with sleep in dogs (18), may induce convulsions in dogs (19) and in monkeys (20) with cortical scars resulting from localizing freezing of the cerebral cortex. While barbiturates produce similar electroencephalographic changes in these species, convulsions do not occur after administration of such agents in dogs or monkeys with cortical scars. This is probably due to the fact that barbiturates raise the threshold of electrical excitability of the cortex while morphine does not (21).

Furthermore, it is postulated that such changes may occur as responses to endogenous or exogenous stimuli, or they may be anticipatory (22). Thus, the electroencephalogram tends to become desynchronized during perception of light flashes, visual hallucinations or vivid fantasies (direct responses) and in anxiety states without such perceptions (anticipatory?). On the other hand, the electroencephalogram tends to become synchronized during relaxation, sleep, and after administration of depressant drugs with or without sleep.

In some respects this hypothesis is supported by direct neurophysiologic evidence. Thus, the existence of neuronal systems which may be responsible for, or at least regulate, spontaneous cortical electrical activity, and which are independent of sensory relay or associative neuronal systems, has been demonstrated (23–27). These "diffuse projection systems" are related to reticular nuclei in the thalamus and brain stem and appear to consist of two main groups. One is confined to the thalamus and when this diffuse system is stimulated electrically, activity in the cerebral cortex is synchronized. When such stimulation is intense, cortical "spike and dome" discharges with arrest of attention and muscular twitching may occur. The other diffuse system is distributed in the reticular formations of the thalamus and brain stem, predominantly in the latter. When it is stimulated, cortical electrical activity is desynchronized, afterdischarges of evoked cortical sensory potentials are reduced, motor activity evoked by reflex cortical (pyramidal) stimulation is diminished, while the animal aroused. Conversely, lesions in the brain stem reticular substance produce synchronization of cortical activity and somnolence. Magoun (28) has pointed out that these two diffuse projection systems are normally opposed to each other and has suggested that the desynchronizing mechanism subserves arousal, while the synchronizing mechanism subserves somnolence. However, as indicated in this discussion, both the pharmacological and neurophysiologic evidence is compatible with the hypothesis that desynchronization of spontaneous rhythmic cortical electrical activity serves to act as a brake on such hyperactivity of "behavior-related" cortical neuron systems as may be associated with arousal, while synchronization of spontaneous rhythmic cortical electrical activity serves to maintain the activity of such "behavior-related" cortical neuron systems as may be depressed in association with somnolence.

Finally, attention should be directed to the necessity of avoiding semantic confusion in considering the possible functions of neurophysiologic "mechanisms". Thus, it is evident from the data presented that the "mechanisms" which subserve arousal, anxiety, hallucinations, fantasies, tremors, relaxation, euphoria, drowsiness, and desynchronization or synchronization of the electroencephalogram, can all be separated from each other; since these phenomena can be observed independently of the others, though under certain conditions, such "mechanisms" are frequently interlocked. The theoretical significance of this conclusion has been discussed elsewhere (29). Here it need only be pointed out that a "mechanism" is merely a concise way of stating that when changes in the indivisible organism are observed with the aid of a certain technic in a well-defined situation, certain data may be expected. Hence, the "mechanisms" subserving "arousal", "hallucinations", "tremors" or "euphoria", etc., can never be identical with those which subserve electroencephalographic changes. However, an attempt has been made here to infer from data acquired by the use of several technics (verbal reports of subjective experiences, neurologic examinations and electroencephalography), the nature of purely neurophysiologic events which may be correlated with changes in the electroencephalogram. Ultimately, the validity of such infer-

ences must be tested with neurophysiologic technics alone.

Summary

1. The clinical and electroencephalographic effects of mescaline, N-allylnormorphine and morphine were studied in 35 experiments on 21 subjects with previous histories of narcotic addiction.

2. The clinical effects of mescaline included the production of anxiety, visual hallucinations, illusions, mydriasis, sweating, tachycardia, hyperactivity of tendon reflexes and tremors. The frequencies of the tremors were between 6 and 8 cycles per second and they appeared at rest and were reduced on voluntary intention movement of the affected part. Concomitantly, the electroencephalograms showed no change, intermittent or continuous replacement of alpha activity by low-voltage fast activity, and/or increase in frequency of the alpha rhythms. Morphine and tetraethylammonium chloride were ineffective in relieving the anxiety produced by mescaline. Intravenous injection of barbiturates abolished anxiety promptly.

3. The clinical effects of N-allylnormorphine included the production of anxiety, irritability, fantasies (daydreams), drowsiness, miosis, pseudoptosis and occasionally, bradycardia. Concomitantly, the electroencephalograms showed no change, intermittent or continuous replacement of alpha activity by low voltage fast activity with or without random slow rhythms or increased rhythmic slow activity. Morphine was only mildly effective in relieving the anxiety produced by N-allylnormorphine, while intravenous injection of barbiturates abolished anxiety promptly.

4. Intravenous injection of morphine produced an immediate experience described as a "thrill", which was followed by relaxation and euphoria. Concomitantly, the electroencephalograms showed no change or increase in rhythmic alpha activity with or without slowing of alpha frequencies.

5. The data indicate that the clinical and electroencephalographic effects of these drugs are determined not only by the chemical properties of these agents but also by other factors which are not clearly defined. However, the "personality" of the individual, his past experiences with drugs and the meaning to him of the experimental situation appear to modify drug effects.

6. In general, and regardless of the nature of the drug administered, shifts in the pattern of the electroencephalogram in the direction of desynchronization occurred in association with anxiety, hallucinations, fantasies, illusions or tremors, and in the direction of synchronization in association with euphoria, relaxation or drowsiness. However, the converse was not true, since such experiences often occurred without any apparent change in electroencephalographic pattern.

7. Detailed analysis of the clinical and electroencephalographic data, and consideration of what is known concerning the functions of the basal reticular and thalamic diffuse projection systems, suggest the following hypothesis: 1) The alpha rhythm of the "resting" electroencephalogram, and the changes in it in the direction of diffusing desynchronization or diffuse synchronization, reflect the activity of one or more neuron systems which, at least in part, are independent of those which subserve such functions as ideation, mood, level of awareness, motility and sensation. 2) The functions of the "independent" neuron system (or systems) are related to cortical homeostasis. 3) Desynchronization of the electroencephalogram occurs when the activity of "behavior-related" cortical neuron systems becomes, or threatens to become excessive, and synchronization of the electroencephalogram occurs when the activity of "behavior-related" cortical neuron systems becomes, or threatens to become greatly diminished. 4) Desynchronization of the electroencephalogram may serve to reduce the activity of "behavior-related" neuron systems, while synchronization may facilitate such activity.

8. It is pointed out that the "mechanisms" which subserve the psychologic, neurologic and electroencephalographic changes produced by drugs can all be separated from each other, though frequently one or more of them are interlocked. The theoretical significance of this conclusion is discussed briefly.

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HEPATOLENTICULAR DEGENERATION

Clinical and Pathological Report of a Case Treated with BAL[1]

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In 1912 Wilson (36) reported in detail clinical and pathological findings in six cases of extrapyramidal disease associated with cirrhosis of the liver, which he called "progressive lenticular degeneration", in distinction to the previously reported cases of "pseudosclerosis" of Westphal-Strumpell, reported in 1883 by Westphal, and in 1898 and 1899 by Strumpell. In 1921 Hall (11) combined the Wilson's disease and Westphal-Strumpell "pseudosclerosis" in one group to which he gave the name of "progressive hepatolenticular degeneration". Since that time many reports of the progressive hepatolenticular degeneration appeared in the literature, although the disease is uncommon. According to Kehrer, (15) Stadler, (28) Andre and Von Bogaert (2), the disease is heredofamilial. The pathology of this disease was described by Wilson and many others, the etiology, however, is still unknown. In 1913 Rumpel (27) found increased copper and silver content in the liver and kidneys of the "pseudosclerosis". In 1930 Haurowitz (12) and in 1945 Glazebrook (10) demonstrated increased copper content of the brain and liver in Wilson's disease. In 1948 Cumings (5) published the findings of the copper in the brain and liver in Wilson's disease which showed a striking difference from the amounts of copper in liver and basal ganglia in other disorders, the amounts in Wilson's disease being greatly increased as compared with normal values. Mandelbrote et al (20) noticed high urinary output of copper in hepatolenticular degeneration which was greatly increased after the administration of BAL. Porter (23) reported increased copper excretion in the urine of four patients with Wilson's disease. All these findings led to the premise that abnormal copper metabolism in this disease caused accumulation of copper in the tissues, particularly in the liver and the brain, inhibiting the enzyme activity and leading to the degeneration of these tissues. During the last war Peters (21) of Oxford University discovered that BAL neutralized the action of arsenic, the main factor in Lewisite, on tissues. Since it was found that BAL promotes the excretion of other heavy metals, including copper, its use was suggested as a treatment in the progressive hepatolenticular degeneration. Accordingly BAL was tried. (31, 6, 30). In 1951 Denny-Brown and Porter (7) published the results of the treatment of five patients suffering from the hepatolenticular degeneration. The case to be reported in this paper is #4 of that group (p. 921).

[1] From the Boston State Hospital Laboratory.

Case Report

This 28-year-old male of Italian parentage was admitted to the Boston State Hospital, June 25, 1952, because of muscular spasticity, difficulty in swallowing, tremor in the right arm and leg, disarthria, mood swings, irritability and assaultiveness. The patient was a full-term nine-pound baby. He had a convulsion at the age of two years and rheumatic fever at 15, without sequellae. Prior to this illness he was robust, healthy, muscular, and mentally bright. He worked in a machine shop. In 1944 at the age of 20 he began to notice progressive difficulty in enunciating words clearly and about a year later he began dribbling saliva. To that was added difficulty in fine movements and in writing with his right hand, and a year later, in 1945, after an emotional upset, a rhythmic tremor of his right leg and arm at rest. He was admitted to the Boston City Hospital where, although very irritable, his face was expressionless. There was a slurred speech, a slight drooping of the left corner of the mouth, poor co-ordination and a coarse intention tremor of the right hand. A Kayser-Fleischer ring was present. He left the hospital against advice, had several admissions to other hospitals and for the past five years had been intermittently under treatment at the Boston City Hospital. In 1946 tremor appeared in both upper limbs and his speech became unintelligible. In 1947 his right limbs and trunk became

rigid. In 1949 he had great difficulty in walking. The tendon reflexes were present and active, and there was bilateral ankle clonus. The abdominal reflexes were present. There was no jaundice. The blood count was normal. The urine showed 4x albumin and a minimal trace of sugar. The resting urinary output of copper was 11 micrograms per hour; this increased to 101 micrograms per hour in the first hour after a single dose of BAL, 2.56 cc. given intramuscularly, representing 4 mgm. per kg. of body weight. In April 1950, he was unable to walk or to feed himself. His limbs were flexed and the mouth wide open, drooling saliva. In June, 1950, he was extremely drowsy, unable to swallow. Spider angioma was present on his chest. Laboratory findings at that time: There was no bile in his urine. The cephalin flocculation test was 4x, the total serum protein 5.30 gm. per 100 cc., the albumin-globulin ration was 2.5/2.8 and the prothrobin concentration 42 per cent. BAL was given, 1.7 cc. intramuscularly, six times in 32 hours without reaction. This was repeated three times at intervals of three days (3.06 gm. in 8 days). Four days later the patient was less rigid, seven days later he was able to swallow, two weeks later tube feeding was discontinued. He began to move his limbs in bed. He received three further courses of BAL without reaction. The patient became less rigid, could walk with support, could write slowly but legibly with pencil. In a few months, with the aid of another course of BAL, he could walk, dress and feed himself. His speech, although slow and gutteral, returned. In May 1951 the patient found that his lower limbs were stiffening and requested further treatment. The copper content in the urine at that time was 422 micrograms per 24 hours. The liver was palpable two fingerbreadths below the costal margin and the spleen enlarged. The cephalin-flocculation test was 4x, the BSP retention 24 per cent and total serum protein 5 gm. per 100 cc. with albumin-globulin ration of 3.8/2.2. He was given a course of 10 per cent solution of BAL in oil, 2.0 cc. twice a day for 13 days. His speech, walking and writing improved, but a month later trembling of the arms necessitated further treatment. He was given eight injections, but after the eighth injection he became uncooperative, attempted to strike other patients, refused to cooperate with the ward nursing staff and caused disturbance on the ward at night. Because of this he was discharged home in June 1951 after nine days of treatment with only slight decrease in spasticity and tremor.

He was admitted to Boston State Hospital, June 25, 1952, because of his mood swings, irritability and assaultiveness, in addition to muscular spasticity, disarthria and inability to take care of himself. Physical examination showed a markedly spastic 28-year-old man with inarticulate speech, able to understand, but corresponding by written messages only. Heart and lungs were negative. Blood pressure was 120/70. Liver was not palpable. Spleen was enlarged and palpable. Face was oily, mouth was open and drolling saliva, a typical Parkinsonian facies. Spasticity of all muscles with grossly incoordinated movements, marked grasp reflex, especially on left, bilateral Babinski, slow movements and a coarse tremor, not typically intention tremor in type, slow rigid gait with the loss of associated movements. He walked slowly with aid only. He could do finger to nose test fairly well, showed no gross sensory defects. Tendon reflexes were present, slightly greater on the left.

Laboratory tests. Liver function tests: icteric index 7.0, BSP 25 to 30 per cent, cephalin flocculation test 2+, total protein 5.6, A/G ratio 3.1/2.5. These changes were similar to the ones noted five years before at the Boston City Hospital. His blood serum Hinton was negative; blood sugar, 81 mg. per 100 cc. of blood; N.P.N., 36 mg.; blood count: R.B.C., 3.750.000; W.B.C., 4,2000; hematocrit, 31; prothrombin time, 15 seconds; bleeding time, 2 minutes and 11 seconds. Total serum protein was 6 gm.; serum bilirubin, 1 mg.; direct reaction, delayed; cholesterol, 197 mg. (Bloor's method). Urine was albumin 3+, numerous red cells.

The patient's motor impairment increased due to progression of spasticity. He lost his ability to write, speech became completely anarthric. During his hospital stay he had several bouts of fever of unknown origin. Blood cultures and laboratory tests showed no changes from the previous findings. He died May 5, 1953 in coma following brief period of fever.

He was unable to swallow for a period of about 18 hours prior to coma.

Autopsy was performed four hours later. The body was that of a powerfully-built and well-nourished young white male, with dark-brown hair and low receding forehead. Pupils were circular and equal and there was a questionable yellowish-gray ring around the limbus. The bodily hair was sparse and its distribution of female type. Nipples were large and pigmented. The heart's shape, size and valves were negative. Coronary arteries were smooth. Aorta was smooth and retracted well. Lungs were free from adhesions, greatly congested at their bases. Liver was small, of normal shape, mustard-brownish color and very firm consistency. The weight was 1000 gm. The surface was nodular, consisting of round projecting firm nodules of different sizes. No normal liver tissue observed on the surface. Sections showed brownish cut surfaces consisting of round areas of varied diameters separated by irregular thick bands of connective tissue. All extra-hepatic ducts were patent. Spleen was large, weight 750 gm. Capsule was stretched and purple-blue. Cut surfaces of the pulp looked flesh-like. Gastrointestinal tract was negative. Kidneys showed nothing of note grossly. Bladder was distended and its mucosa was congested. Prostate was small. Both testicles were atrophic.

Head: Calvarium was very thick. Dura mater was negative. Brain weighed 1000 gm. It was small and surprisingly firm to touch. The pia-arachnoid was thin and transparent. The gyri were sharply outlined and sulci deep. There were no foci of softening on the surface of the brain. The vessels were thin, supple and delicate. The cranial nerves showed nothing of note. The basal pia was slightly thickened.

Section 1. Through the middle of the frontal lobe showed no gross changes. The cortex and the subcortical white matters were well differentiated, showed no gross evidence of necrosis. The white matter was very firm to touch.

Section 2. Through the anterior third of the temporal lobe: lateral ventricles were not dilated. Caudate nuclei showed no changes. Putamina were well formed, showed no changes in consistency. White matter of the centrum ovale was very firm. Temporal lobes showed no changes.

Section 3. Through the anterior half of the tuber cinereum and the optic chiasma showed slight dilatation of the lateral ventricles. Internal capsules appeared intact. Both putamens were very soft to touch, especially the left, without showing changes in color or contour. Claustrum and island of Reil were negative.

Section 4. Through the middle of the temporal lobes: the outline of the gyri, corpus callosum and the white matter were very firm to touch. Both putamina were very soft to touch but showed no gross structural changes. The posterior surface of the same section (6 mm. thick) showed a small lesion at the postero-inferior end of the left putamen and several vertical, very narrow, almost linear softenings. Left globus pallidus was soft to touch. The changes in the right putamen and right globus pallidus were less pronounced. Both internal capsules appeared intact. The lower end of right claustrum and insular white matter were reddish.

Section 5. Through the posterior end of temporal lobes showed necrotic changes of both putamens, more pronounced in the lower half. The white subcortical matter and convolutional white matter were very firm. Ammon's horn was very firm. Cord was grossly negative. The pituitary gland was grossly negative (fig. 1).

Microscopic examination: H & E, Cresyl-blue, Loyes and Mallory's stain for glial fibers were used. Pio-arachnoid is very wide, made up of a large number of wavy delicate parallel fibers enclosing widely dilated congested vessels. The subcortical white matter was edematous. The cortical and subcortical vessels were dilated and overflowing with blood, and there was perivascular and perneuronal dilatation without cellular infiltration. Although the cyto-architechural pattern of the cortex was preserved, there was a loss of cells, especially in the third layer, and the remaining nerve cells showed mild to moderate changes. In the motor area Betz cells were preserved, although many of them appeared overstained. Groups of 10 to 12 glial cells forming a sort of a rosette or a mound were seen in the white gyral matter of the cortex. The cortical vessels

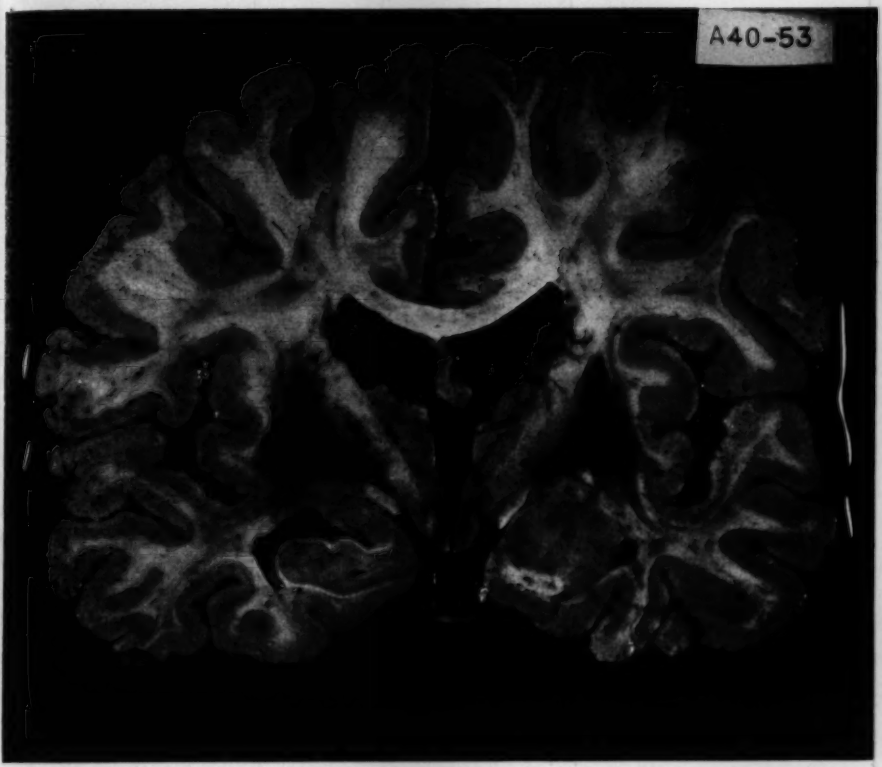

FIG. 1.—Cross section of the brain to demonstrate the gross changes in both putamina, esp. the left. Both putamina are very soft to touch and congested.

showed no thrombi, no endothelial proliferation, no perivascular infiltration.

Basal ganglia. Putamina consisted of broken down, edematous tissue with most of the cells and fibers missing, especially in the left putamen. The few remaining cells were shrunken, overstained and contained fat granules. The glial overgrowth was prominent and in places showed secondary degeneration. Alzheimer's cells were infrequent. No single large cavity was present, but a rarefied tissue with numerous glial cells. The internal and external capsules appeared intact. The globi pallidi showed little damage, having lost only a few cells.

The vessels of the lenticular and caudate nuclei were dilated, filled with blood here and there, forming early thrombi. The Virchow's spaces were dilated but not infiltrated. Loyes stain for myelin-sheaths showed well preserved myelin in thalami, candate nuclei globi pallid, and both capsules. The only abnormality was found in putamina. Cerebellum showed mild changes in Purkinge cells. Cord: the cells of the horns and myelin sheaths were well preserved.

The microscopical picture was one of the lenticular degeneration of chronic Westphal-Strümpel type.

Liver: The architectural arrangement of lobules was completely distorted. The lobules were of different sizes and irregular shapes. Labules were outlined by stands of connective tissue infiltrated with various inflammatory cells—lymphocytes, plasma cells and, in place, polynuclear, leukocytes. The degree of cellalar infiltration was severe. Small bile ducts were numerous. Hepatic cells showed an extreme degree of fatty degeneration and necrosis. No

FIG. 2.—Section of the liver to demonstrate lobular cirrhosis.

hepatic cells were seen that could be called normal. Copper of liver tissue gave positive results. Ceroid pigment was not found (fig. 2).

Spleen: Malpighian corpuscles showed no changes. The pulp was very cellular and fibrous tissue in the pulp increased. The sinuses were tortuous, dilated and congested and there were many diffuse hemoerhages.

Kidneys: All the vessels were greatly congested and overflowing with blood. Many glomeruli were shrunken. Tubules showed dilatation and severe epithelial changes.

DISCUSSION

The etiology of the hepatolenticular degeneration is still unknown, but the findings of increased resting urinary output of copper and post-mortem findings of large amounts of copper in the tissues, liver and brain, especially in the basal ganglia, led to the theory of impaired copper metabolism as a cause of hepatolenticular degeneration. Denny-Brown and Uzman (33) found amino-aciduria in a case of Wilson's disease in the absence of demonstrable hepatic or renal dysfunction. Porter (24) found excessive amino-acid excretion even in early and mild states of this disease. Both abnormalities may be present, but it has been commented upon that BAL increases the urinary excretion of copper, but not of amino-acid nitrogen (4). The time relationship of the liver and the brain degeneration follows: It has been noticed by Stadler (29), Waggoner and Malamud (35), Herz and Drew (13) that the brain lesions not unlike those of Wilson's disease may follow ordinary acquired liver disorders. Two cases beginning as hepato- and splenomegaly (Banti's Syndrome) and showing typical Wilson's disease after splenectomy were described by Rabiner et al. (25) and by Richter (26). Verger and Leger (34) did liver biopsies in two cases of Wilson's disease

which showed lobular cirrhosis of the liver. Wollager and Shands (37) described two cases in which hepatic lesions were symptomatically more prominent than the neurologic ones, and Tretiakov reported two cases of acute abdominal form antidating by several months the neurological signs indicating the primary affection of liver. Luthy (19) has described three forms of the hepatolenticular degeneration: 1. hepatic abdominal form, 2. typical Wilson's Disease, 3. Westphal-Strümpell's pseudosclerosis. Wilson (36) in his monograph says that in the classical form neurologic symptoms predominate, cirrhosis may be almost symptomless. Abdominal signs, ascities, edema and splenomegally, appear late. Operations have been performed because of the diagnosis of Banti's disease or tuberculous peritonitis, with neurological symptoms following the operation.

The descriptions of the pathological findings in the liver and the central nervous system have been reported by Wilson (36), Richter (26), Hoesslein and Alzheimer (14), Fracassi (8), Altschul and Brown (1), Rumpel (27), Stadler (28), Leigh and Card (17), Konovalov (16), Freedberg (9), Lidbeck and Larson (18), and others. Changes of different degrees in the basal ganglia have been described by all, but several authors found changes in the cortex. Some consider the term hepatolenticular degeneration not inclusive enough, Baltzan (3) suggesting "hepato-cerebral syndrome" instead. The typical pathological findings in the brain are: symmetrical softening of putamina which may consist of severe edema with grossly recognizable structures, "status spongiousus" or deep cavities, much lesser and milder involvement of the globus pallidus and caudate nucleus, severe degeneration of nerve cells which is also found in the cortex or in the dentate nucleus, and proliferation of glia. Secondary degeneration of these glia cells and Alzheimer's glia cells are usually present. No perivascular cellular infiltration or proliferation is usually present. The walls of the cerebral vessels may show hyaline degeneration.

The pathological findings in our case do not differ from these typical findings.

In his Cameron lecture Peters (22) discussed the tissue changes arising as a result of interference with essential enzyme systems at the pyruvate stage. He emphasized that these changes may be too subtle to be recorded by histological methods, the demonstrable lesion having become the end result of biochemical disturbance which he calls "biochemical lesion". He emphasized that enzymatic process could be arrested before the complete and irreversible destruction of the tissue occurred. Peters had proved that in the arsenic poisoning the oxydation of carbohydrate at the pyruvate stage is affected because of arsenic's affinity for —SH groups. BAL removes the arsenic from the pyruvate system because of its greater affinity for —SH groups, thereby freeing and restoring the pyruvate enzymatic system. Since the increased copper excretion in the urine and deposits of copper in the brain (especially basal ganglia) and liver in the patients with hepatolenticular degeneration had been reported, and the increased elimination of copper after BAL injections noted, this treatment was carried out with considerable and, in some cases (22), striking success.

Peters called attention to parallelism between the effects of vitamin B_1 deficiency and toxic action of arsenical on the brain tissue, because both are concerned in different ways with enzymes oxidizing pyruvic acide. Like other heavy metals copper inhibits the enzymatic activity. We do not know at what level of degradation of carbohydrate the copper may poison the enzymes, but its effect on the tissue, especially the basal ganglia, is unmistakable. The reversibility of its effects on brain tissue, after the administration of BAL, seems to prove that the biochemical lesions can be treated, even if the underlying cause of the copper metabolism disturbance is not affected by it. It seems logical to expect clinical benefit in cases of hepatolenticular degeneration, especially in the cases in which the treatment was started early and the improvement kept steady, by regular maintenance doses. In our case the treatment was started after six years' duration, and the improvement was very great. The treatment had to be stopped because of the patient's mental uncooperative condition two years before his death, upon which all the symptoms have returned. The improvement was explained by the removal of the heavy load of copper from the tissues. As soon as the copper reaccumulated, the symptoms reappeared. Ap-

parently the biochemical condition of the tissues reverted to its original pre-treatment state and the postmortem pathological findings, gross and microscopical, were indistinguishable from those described in typical untreated cases.

According to Cumings (5) the average copper content of normal liver is 10.7 mg. per 100 gm. of dry liver. In three cases of hepatolenticular degeneration he had found 156.4, 55.0 and 39.4 mg. per 100 gm. respectively. The average amount of copper in the normal putamen is 9.3 mg. per 100 gm. In two cases of hepatolenticular degeneration Cumings found 60.5 and 69.3 mg. per 100 gm. The chemical analysis of the brain (basal ganglia) and liver in our case showed 41.3 mg. per 100 gm. of dry liver and 25 mg. per 100 gm. of formalin-fixed brain. As our study showed no changes in the type of the lesion which could have been ascribed to the effect of BAL, one can regard it as a proof that the clinical symptoms had returned with the return of the deposition of copper when the treatment was stopped. It seems that BAL maintenance treatment is as necessary in the hepatolenticular degeneration, as liver in pernicious anemia or insulin in diabetes.

Summary and Conclusions

1. A case of hepatolenticular degeneration treated with several series of BAL two years before the patient's death is reported.

2. The neuropathological findings do not differ from those in untreated cases, which supports the idea that clinical improvement was due to an increased elimination of copper produced by BAL during the treatment period.

3. In the period of two years following the treatment there was reaccumulation of copper as shown by the chemical analysis of the brain and liver tissues, with detrimental effect.

4. It seems that continuous maintenance treatment with BAL is indicated.

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THE COURSE OF WARTIME SCHIZOPHRENIA COMPARED WITH A CONTROL GROUP [1]

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The present communication is a report of the course of illness over a period of 5 to 8 years of 341 patients with schizophrenic reactions whom the authors cared for during World War II in a combat zone in New Guinea. It follows a preliminary report of the first 100 of these patients published earlier (6). Since we had planned a follow-up study at the time of our original contact with these patients, observations were made with that in mind. The special wartime situation offered opportunity to observe an experiment of nature in which individuals were removed from their usual environment, placed in a military setting on an isolated tropical island, and then returned to the usual problems of civilian life.

It was felt that significant factors in schizophrenia might be pointed up by a comparison with a group of veterans of comparable age, race and background who saw service of comparable duration in the same area, who were members of the same military organizations, and in whom psychiatric disability was not found during wartime service. Our interest was in the capacity of the individual to withstand such demands on his adaptive processes and in the particular maladaptation called schizophrenia.

A schizophrenic reaction was defined as one in which the patient showed definite evidence of disorganization of thinking, with withdrawal from reality and responsiveness to imaginary stimuli with hallucinations or delusions.

We asked ourselves first what the course of the illness was and whether or not it differed from that of acute schizophrenia seen in civilian life. We next asked ourselves, "What, among this group of individuals, constituted a stressful situation or event?" Next, "Can one identify anything about an individual which may predispose him in a suitably stressful situation to a schizophrenic pattern of illness?" If the illness is an episode consistent with the life-long pattern of reaction, can potential schizophrenics be detected at the induction station? Is the widespread idea that wartime schizophrenia is a relatively benign process correct or not? Can a schizophrenic breakdown be recognized in its early stages so that patients could be brought under care early and a costly and difficult-to-manage acute episode of excitement or stupor be avoided? Can the man who has had an acute schizophrenic illness perform useful military service afterwards? What integrating forces are helpful in preventing such illnesses, and which can be used in a military setting? What factors, in scrutinizing a group of men who did not break down under similar circumstances, contribute to our understanding of schizophrenic illness and the over-all problems of mental health in a military setting overseas? What recommendations can be made that will be of present and future value to the military services?

METHOD OF PROCEDURE

Among a group of approximately 2500 psychiatric patients seen in a general hospital in the combat zone in New Guinea during World War II, 341 were considered to have schizophrenia. They form the basis of this report. From this group, often with the assistance of the American Red Cross, we were able to make personal contact with 156 of our former patients 5 to 8 years after their original hospitalization. The remainder of the patients were studied through their Army and Veterans Administration medical records. (These records were located, photostated and made available through the generous assistance of the National Research Council's Division of Medical Sciences and their statisticians, Dr. Gilbert W. Beebe and Mr. Seymour Jablon.)

The diagnosis of schizophrenia had been made on the basis of a period of observation

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CHART 1. SYMPTOMS DURING ILLNESS OVERSEAS

Symptoms	*Per Cent*
Total cases of hallucinations	97
Auditory hallucinations	64
Visual hallucinations	44
Other hallucinations	4
Confusion	67
Disorientation	60
Defective judgment	57
Seclusiveness	47
Inappropriateness of affect	46
Depression	45
Insomnia	40
Muscle tension	36
Inappropriateness of behavior	33
Excitement or agitation	32
Prominent anxiety or apprehension	31
Ideas of reference	31
Headaches	30
Restlessness	30
Circumstantiality or irrelevance of talking or writing	27
Hypochrondiacal complaints	24
Irritability	24
Psychomotor retardation	24
Memory defect	23
Difficulty in concentration	23
Suicidal thoughts or attempts	23
Shaky, tremulous or twitching	22
Disorganization of talk	22
Somatic delusions	20

of at least 3 weeks and as long as 5 months. It required clear-cut evidence of disorganization of thinking and behavior and nearly always hallucinations. The psychopathologic symptoms observed are listed in chart 1. Uncertain cases were not included in this study. Records of the data gathered at the time of the acute illness were reviewed at the time of follow-up. Fifty-six of the group were interviewed at length 5 to 8 years after they had been evacuated to the United States. From each one a large body of data was gathered as appears in the accompanying charts. In the cases of three men, only the parents could be interviewed. Six additional men were interviewed by social service workers. The remainder were contacted through a detailed and "personalized" questionnaire.

Matching of the Schizophrenic and Control Groups. The control series of 30 patients was carefully prepared by the statistical section of the Division of Medical Sciences of the National Research Council. They were men of the same age group who had served in the same units and at the same time as the schizophrenic patients but whose records showed no psychiatric diagnosis or other illness such as obesity, hyperthyroidism, migraine, syncope, peptic ulcer, ulcerative colitis and functional diseases of the stomach or intestinal tract. It happened that there were no significant differences in race, marital status or background with respect to rural, urban or metropolitan living between the schizophrenic and control groups, as shown in chart 2. Twenty-nine per cent of the schizophrenics and 31 per cent of the controls had had better than an eighth grade education. Even from the standpoint of early stresses growing out of the death of parents during childhood, there were no significant differences between the schizophrenic and control groups.

Fifteen of the control men were personally interviewed and an additional 15 filled out the questionnaire. It is of special interest that the data obtained from those interviewed and

CHART 2—PERSONAL DATA

	Per Cent of	
	Schizophrenics	*Controls*
Age *		
Below 20	7	11
20 to 24	49	50
25 to 29	30	22
30 to 34	11	17
35 to 39	4	0
Race		
Negro	21	16
White	74	80
Mexican, Philippine, Indian, etc.	5	4
Marital status		
Single	78	80
Married	25	17
Divorced	8	3
Had children	13	3
Background		
Rural	35	17
Urban	45	50
Metropolitan (city larger than 150,000)	20	33
Death of mother before subject 14	7	13
Death of father before subject 14	8	17
Death of both parents before subject 14	1	3
Schooling past eighth grade	29	31

* Age of schizophrenics when seen at Ninth General Hospital. Age of controls when inducted.

from the questionnaire did not differ substantially in either the schizophrenic or the control group.

The original observations of the schizophrenic group were made and recorded by the authors in an Army general hospital that received patients who were participating in the campaigns in New Guinea and the Philippines from 1943 to 1945. Previous reports have surveyed other aspects of the psychopathology which was encountered (7, 8, 9). These patients had been subjected to a variety of stresses. Mail from home arrived irregularly and usually after an interval of weeks or even months. Furthermore, when news of illnesses, deaths and infidelities was received, it was impossible for the men to take any direct action. There were no furloughs and little opportunity for recreation. Rodent and insect pests were numerous, annoying and sometimes dangerous. The tropical heat was oppressive, especially when exertion was necessary. The food, although usually of sufficient quantity, was unappetizing and of inferior quality. It should not be assumed, however, that the circumstances of military life in a combat zone were necessarily more stressful than those of civilian life for any specific individual. Many found the security and limited responsibilities of the army easier to bear than the hectic circumstances of their lives at home. About one half of the men in this study had taken part in active combat, and most of the others had been subjected to periodic bombing attacks.

Sources of Error and Difficulty

Many problems and sources of error were encountered in this study. As noted above, it was not possible to have personal interviews with the whole group. We had originally hoped to include 300 in the control group; however, we were supplied with the names and addresses of only 60 individuals. Because of failure of some to respond and the lack of data on some who were reached, the number on whom we had satisfactory information was reduced to 30. Much subjective evaluation was involved in the method. There was sometimes conflict between the data given at the time of the acute illness and at the time of follow-up. Undoubtedly the data at times reflected the feelings rather than the objective facts of the patient's situation. This was not necessarily a handicap because a patient's interpretations do provide in themselves a source of information about him. Such data might be especially helpful in determining the capacity of the individual in relation to the demands of his environment.

In many instances the impression was obtained that patients were exaggerating their symptoms, either unconsciously or consciously motivated toward an increase in pension. Undoubtedly falsification also occurred in the other direction because of a desire to give socially acceptable answers. Many times discrepancies were quite easily identified even in a questionnaire so that a fairly accurate appraisal of the situation could be made. For example, the questionnaire of one patient whose replies implied that he was now well adjusted was interpreted by the authors as indicating persistent evidence of schizophrenic illness. This evaluation was soon confirmed in a letter from physicians at the hospital where he was still committed with a severe paranoid schizophrenia.

Data from the control group are also undoubtedly subject to inaccuracies. Nevertheless our evaluation was carried out as objectively as possible without reference to whether the individual was a member of the schizophrenic or control group. In spite of the problems and possible sources of error, we feel that many significant data have been adduced allowing for reasonably valid conclusions.

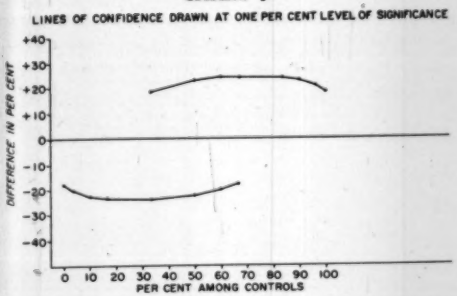
Method of Analysis of Comparative Data

The data gathered were tabulated in the form of percentages for the control and schizophrenic groups. The significance of differences between the two groups was then determined by the method of chi-square using a fourfold table. Lines of confidence were drawn on the graph shown in chart 3, constructed so that chi-square was 6.64, and only differences significant to the 0.01 level were listed in the charts. (The authors are grateful to Dr. Carl R. Doering for help with the statistical analysis.)

Characteristics and Natural History of the Schizophrenic Illness

The chief criteria for the diagnosis of schizophrenia have been mentioned above. The group

CHART 3



comprised approximately 15 per cent of all admissions to the psychiatric service of the Ninth General Hospital in New Guinea. Nearly half of the patients were referred because of an acute catatonic excitement or stupor. In most of these, there was evidence in the field medical record of milder but ominous symptoms of disorganization for days or weeks prior to the acute episode. These symptoms included excessive seclusiveness, somatic delusions, nightmares, and bizarre impulsive behavior. Among all of the schizophrenic patients only 19 per cent seemed to have undergone a sudden personality change. Forty-nine per cent gave evidence of a preceding gradual change, and in 32 per cent there was clear-cut evidence of long-established schizoid tendencies such as seclusiveness, "eccentricity," confusion, unreality feelings, etc. The symptoms most commonly occurring during the illness overseas have been referred to in chart 1.

The incapacity to deal with frustration, as emphasized by Jenkins (4), occurred in many of the patients. They did not have a normally well-organized pattern for dealing with life which is usually accompanied by toleration of frustration and a plan for working out problems. Analysis of the reason for steady employment prior to entering the Army, which often was inappropriate to the educational background, revealed that the individual felt comfortable in work to which he had become accustomed and which he was afraid to leave to accept a position that might be an advancement but would require the assumption of greater responsibility. In most of the group of patients it appeared that the Army enforced greater demands for adaptation than did the circumstances of their civilian life.

In the treatment of these patients in our hospital overseas, emphasis was placed on providing a friendly supporting atmosphere, opportunities for working off tensions in vigorous recreation and sports, occupational therapy and frequent opportunities to sit with the physician and talk. The patients remained under treatment in our hospital from 3 weeks to 5 months prior to evacuation to the United States.

The period of hospitalization after return to the United States varied from less than one month to over a year, as shown in chart 4. An evaluation of therapy received in hospitals in the United States suggested that remission of symptoms occurred most consistently with electroshock treatment (chart 5). However, insulin shock therapy and hospital routine and psychotherapy had both been accompanied by moderate or marked improvement in a high percentage of the cases, 45 per cent and 56 per cent, respectively. Response in the small number of cases that had been in special rehabilitation programs was not very favorable. After discharge from the hospital, a surprisingly large

CHART 4

A. HOSPITALIZATION FOR PSYCHIATRIC ILLNESS

Hospitalization	*Per Cent*
Overseas	
1 month or less	21
2 months	54
3 months	18
More than 3 months	7
In United States—including V. A. hospitals (not recurrences)	
1 month or less (30 days or less)	8
1 to 2 months (31 to 60 days)	34
2 to 3 months (61 to 90 days)	24
3 to 4 months (91 to 120 days)	13
4 to 5 months (121 to 150 days)	7
5. to 6 months (151 to 180 days)	7
6 to 12 months	2
More than 12 months	5

B. RECURRENCES OF PSYCHIATRIC ILLNESS AFTER ORIGINAL HOSPITALIZATION

	Per Cent
Illness requiring hospitalization	
One	9
More than one	6
Illness not requiring hospitalization	
One	5
More than one	3

CHART 5

A. THERAPY IN HOSPITAL IN UNITED STATES

Treatment	*Degree of Improvement*			
	Marked	*Moderate*	*Slight*	*None*
	%	%	%	%
Electroshock (45 cases)	40	24	20	16
Insulin (29 cases)	21	24	34	21
Hospital routine and psychotherapy (234 cases)	15	41	33	11
Special rehabilitation program (9 cases)	11	22	45	22

B. THERAPY AFTER DISCHARGE FROM HOSPITAL

Treatment	*Degree of Improvement*											
	Marked		*Moderate*		*Slight*		*None*		*Unknown*		*Total Patients*	
	No.	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%
None or no record											220	66
Treated in V. A. clinic					1	5	5	25	14	70	20	6
Treated in V. A. hospital	6	14	9	21	13	30	14	33	1	2	43	13
Treated by private physician	2	4	3	5	16	29	24	43	11	20	56	17
Total receiving treatment	8	7	12	10	30	25	43	36	26	22		

number of the patients had had no treatment or no regular treatment so that relatively little had been done in regard to their rehabilitation (chart 5).

Most of the patients' contacts with the Veterans Administration had been for determination of compensation status. The treatment program developed by the Veterans Administration mental hygiene clinics was not yet in effect at the time these men were discharged from the military service. Even after their establishment, the policy in many of these clinics was to emphasize the treatment of those with psychoneuroses and the rejection of those with schizophrenia as not suitable for intensive psychotherapy.

The recurrences of psychiatric illness after the original hospitalization are shown in chart 4, indicating that 15 per cent required further hospitalization and 8 per cent had distinct exacerbations but were able to remain outside of the hospital. It is likely that this figure is too low because of a lack of accurate data.

Chart 6 gives an evaluation of the degree of disability during the follow-up period. This table indicates that with time there was a trend toward gradual decrease in disability as measured by an estimate of the total functioning capacity. Five or more years after discharge

CHART 6.—DEGREE OF DISABILITY

	Length of Time After Discharge				
	1 Year	*2 Years*	*3 Years*	*4 Years*	*5 or More Years*
	%	%	%	%	%
Marked	48	28	22	23	20
Moderate	38	46	46	33	35
Mild	8	19	20	25	20
None	3	4	8	13	16
Unknown	3	3	4	6	9
Total	100	100	100	100	100

from the Army, over a third (largely those with catatonic syndromes) had little if any social disability. However, it should be noted that many of these, although functioning well, showed minor personality deviations characteristic of schizophrenia. Disability was severe in 20 per cent. Five per cent were being cared for in psychiatric hospitals. Eight per cent had had definite exacerbations of their illness but had remained at home, and 15 per cent had had attacks that had required one or more further hospitalizations.

Chart 7 shows the compensation first received from the Veterans Administration and that received at the time of the last follow-up 5 to 8

CHART 7.—COMPENSATION RECEIVED

Per Cent Compensation	*Per Cent of Individuals*	
	Initial	*At last follow-up*
100	34	9
60–70	15	4
40–50	28	10
20–30	14	23
10	2	31
0	3	20
Unknown	4	3

years later. These figures show that at the beginning over a third of the patients were receiving 100 per cent disability and only three no compensation. Five to 8 years later only nine were still receiving 100 per cent, about a third of the men 10 per cent, and one-fifth no compensation. Investigation of the attitude toward compensation revealed that 58 per cent felt that they should be getting more and 41 per cent felt that they were receiving fair compensation. A single individual felt that the compensation was not deserved.

During the interviews it was common to obtain circumstantial and inappropriate responses. Many of the florid symptoms had subsided in a large number of patients, although most of them continued to show definite stigmata of schizophrenia of varying degree such as evasiveness, suspiciousness, illogical thinking, circumstantiality, lack of depth of emotion, talking beside or beyond the point, excessive fantasy-life and difficulty in dealing with concrete problems. As observed in civilian practice, those with the most flagrant schizophrenic reactions such as catatonic stupors or excitements had made the best social recovery.

For example, a 23-year-old man had become confused over a period of a few days but protested that there was nothing wrong with him and that he wanted to continue on duty. He rapidly lost contact with reality and developed auditory hallucinations, paranoid delusions, incoherent, rambling speech and disruptive behavior on the ward, so that he had to be kept by himself. His illness developed in the setting of prolonged service overseas, resentment over the fact that the army band in which he was a sergeant had been made a separate unit rather than continued as part of a division, being subjected to air raids, several attacks of malaria and a mild but irritating ringworm infestation of his skin. He also had an orchitis on the right testicle which had recurred shortly before his illness and had aroused worry of possible sterility and guilt about masturbation. He was also concerned about his twin brother, who was in combat in Europe and who later also developed schizophrenia. Psychotic manifestations in our patient lasted for several weeks, with rapid remission after return to the United States where he was treated with routine psychiatric hospital activities and brief psychotherapy. At the time of discharge he was given 30 per cent disability compensation which was eliminated in one year.

Subsequent adjustment has been an excellent one. He re-established good relationships with his family and friends, married a motherly, tolerant, intelligent woman who has given him much support, made a good heterosexual adjustment and had three children of whom he is very fond. He has been working effectively in a responsible job with others working under him in his capacity as a minor executive at an airport. He has continued to display mild anxiety and restlessness, occasional trouble in starting his urinary stream, and occasional headaches. He remains somewhat critical of the way patients were handled in army hospitals and likes to feel that this is to some extent responsible for the severity of his illness. However, on the whole he has a favorable attitude toward the army and feels that all men should have some experience in the military

CHART 8

SYMPTOMS AT TIME OF LAST FOLLOW-UP

Symptoms	*Per Cent*
Preoccupation with multiple bodily complaints	47
Tremulousness	32
Headaches	28
Seclusiveness	28
Irritability	27
Restlessness	23
Anxiety	22
Insomnia	22
Apathy, lack of interest	18
Depression	17
Fatigability, weakness	16
Paranoid trends	16
Grossly defective judgment	14
Lack of energy	12
Confusion, difficulty in concentration	11
Nightmares	10
None	12

CHART 9
PERSONALITY TRAITS PRIOR TO MILITARY SERVICE

	Per Cent of	
	Schizophrenics	*Controls*
Reserved	41	10
Rigid	21	0
Immature	54	3
Emotionally stable	17	67
Friendly, outgoing	26	80
Feeling of inferiority	28	3
Consistent interests	25	89
Solitary pursuits	41	17

CHART 10.—INTERPERSONAL RELATIONS

	Per Cent of	
	Schizophrenics	*Controls*
Harmonious with family	27	69
Over-dependent	19	0
Good social adjustment	32	80
Good adjustment in school	43	70
Seclusive	33	0
Capable of assuming responsibility	7	70

service. His twin brother's recovery was less complete and he has continued to display schizoid behavior.

The over-all adjustment picture in these patients suggests possibly somewhat less deterioration than is usually found in schizophrenia among civilians who have to be hospitalized. However, the rigid requirements of adjustment in the army made it necessary for many mild cases to be admitted to a hospital. Had they not entered the army, they might have remained as ambulatory civilian schizophrenics. In some cases, especially in those who were making a fairly adequate adjustment, the diagnosis was changed to some type of psychoneurosis after return to the United States. Later the diagnosis of schizophrenia was again applied to many when symptoms recurred. The symptoms present at the time of our follow-up study are listed in chart 8.

COMPARISON OF SCHIZOPHRENIC AND CONTROL GROUPS

A comparison of the schizophrenic and control groups in which certain personality traits before military service were contrasted indicates that the schizophrenics were more reserved, rigid, immature, subject to feelings of inferiority, less consistent and narrower in their range of interests (chart 9).

In regard to interpersonal relationships, the control group experienced more harmonious family life, less overdependency, a better school and social adjustment, less tendency to seclusiveness and much greater capability in assuming responsibility, as shown in chart 10.

These findings agree strikingly with the findings of Campbell (2) and Bowman and Raymond (1), who made a statistical analysis of the prepsychotic personalities of civilian schizophrenics.

With respect to stresses in the military service, homesickness was very prominent among the schizophrenics as shown in chart 11. As regards misassignments, disasters occurring at home, deaths of comrades, etc., there was no significant difference between the experience of the schizophrenic and control groups. It is noteworthy that although 57 per cent of the control group and 44 per cent of the schizophrenics served in actual combat, the controls suffered significantly less physical injury. The controls had much more prolonged overseas service because of the fact that the schizophrenics were all evacuated to the United States with their illness.

CHART 11.—STRESSES IN MILITARY SERVICE

	Per Cent of	
	Schizophrenics	*Controls*
Homesickness	21	0
Prolonged period overseas (more than 12 months)	41	70
Courts-martial and company punishment	23	3
Physical trauma in service	27	7

CHART 12
COMPARISON OF POSTWAR TO PREWAR ADJUSTMENT

	Improved		*Poorer*	
	Per Cent of		*Per Cent of*	
Area	*Schizophrenics*	*Controls*	*Schizophrenics*	*Controls*
Family	14	57	25	0
Social	12	33	35	0
Sexual	18	61	21	0
Economic	12	64	38	4

It was our impression that although a high percentage of the control group did not care for military service, they were able to make the best of it and frequently felt that it promoted their development and maturity. One man commented, "My army experiences were good in some ways. They gave me more confidence in myself. Whether I would have changed anyway in civilian life, I don't know. I was in from the ages of 23 to 28. I had a lot of fun. When I got leave in Australia, I did more extreme things—women, drinking, and playing. I thought it might be my last chance. Some wanted to have an experience with women before the final curtain pulled down. I was looking toward the future, too. I saved money when I was overseas and have now put it into a down payment on a home. I was able to accumulate more money in a few years than my father, who is now 66, was able to do in 50 years of house-painting."

Chart 12 indicates that there was a highly significant difference between the postwar and prewar adjustment of the schizophrenic and control groups in the social, family, sexual and economic spheres. The control group had achieved a firmer adjustment with the passage of time while the adjustment of the schizophrenic group had deteriorated in the postwar period. Their ability to function at work, their family relationships and their sexual and social adaptations were all less satisfactory. The findings are in substantial agreement with those of McDaniel and Diamond in a group of discharged neuropsychiatric casualties (5). The differences in postwar status of the two groups are shown in chart 13, which points up the regressive pattern of the schizophrenics.

Factors promoting mental health were brought into focus by our consideration of the control group. Those most frequently emphasized by these men were the spirit of the individual military organization, confidence in the weapons and other equipment, respect and affection for officers and other fellow soldiers, faith in being properly trained and prepared to carry out a given task, good physical condition, high quality of food well prepared and recreational outlets. When such positive influences were strong, it was easier for the average soldier to have a strong desire to serve.

CHART 13.—PERSONAL DATA, POSTWAR

	Per Cent of	
	Schizophrenics	*Controls*
Living at present with		
Parents or close relative	24	3
Wife	59	93
How much with others		
Normal social contacts	38	100
Less than normal	35	—
Rarely	27	—
Recreation		
Normal	40	100
Less than normal	60	—
Work adjustment		
Steady worker	40	100
Irregular worker	26	—
No regular employment	34	—

Useful service, even in combat, was given by many soldiers for long periods of time when morale was high in spite of severe neuroses or psychoses. Where there was a lack of sense of responsibility and desire to get well or carry on, individuals were prone to utilize and enlarge upon their symptoms and to be handicapped early in carrying on effectively. They tended to use rationalizations which implicated other individuals or the environment. The common scapegoat was the weather. Broad experience in World War II indicates that the weather was a common excuse in units all over the world, no matter what the climate might be. Where it was possible to maintain an interest in the environment rather than dwell on the unpleasant features, there was another sustaining influence.

This is illustrated by the comment of one of our control group, who stated, "It is my impression that my G.C.T. score was considerably higher than the average. (General Classification Test was administered to all army personnel during the period of basic training. It was designed to indicate roughly the level of intelligence and the direction of aptitudes.) From watching the men around me—most of whom were in the Southwest Pacific area 36 months or better before being sent home—the better mentalities made their way much better than those not so well endowed. I liked the tropics, which I think was a factor. As small an item as a course in Oriental Studies at the U. of W., coupled with a course in Chinese

language and a great deal of reading on the Orient and Oriental philosophy, did more to stabilize me emotionally than anything that I can recall. It added quite a little to my ability to accept the army with its asininities. I was raised to limit my emotional show and believe that it is the most satisfactory manner of living. I was very fortunate in the assignment of duties while in the army, had work I liked and acquaintances that I enjoyed at all times in my army career."

The comments of another illustrate in a man's own words some of these factors: "I think the most important factor in keeping me going was not wanting to be a coward in the eyes of the men around me. I was able to say, 'If it gets you, it get you, so what.' I did things I shudder about now."

Several pointed out that the men had to keep going until they got sick or got killed: "It was depressing that you never knew when you'd be sent home." A protective, functional emotional blunting seems to have been helpful to some men. One said, "When you are in the infantry, you get mentally lazy. You get so you can sit for hours and not think. That is a good thing in the infantry but a bad thing in the lecture room in the university."

Some of the men considered that it was helpful to have known some of the men in civilian life and to have buddies who came from the same part of the country, which gave them more in common. One sergeant stressed the importance of leadership in the group: "Certain guys are leaders. They may first show it in a gang of kids. It's not measured by the bars on your shoulder. One of the men was well-muscled, but it was hard to get him to do a thing. At Salamaua he stuck in his foxhole. I gave him more responsibility for the new replacements. He rose to the occasion at Biak but was killed."

Consistency, fairness and ability were stressed as positive factors in leadership. One sergeant said, "Men were too often kept on edge by the platoon sergeants. There was too much unnecessary barking out of orders. I got better cooperation from my men by giving reasons."

The ability to handle combat situations increased up to a point by experience with them. One man stated, "At first I had a numbing feeling; it was sickening. There was a disgust for the whole thing. With experience I got hardened to it. I didn't like to handle my buddies when they were dead. I did not feel that way about the Japanese. I built up a hatred that helped carry me through."

There is a recurrent theme, in those who maintained good adjustment, of getting the most out of every situation even though it may have been very unpleasant. In contrast, those who failed to adjust often avoided advantages that might have been offered because of lack of intellectual resources, poor educational background or emotional rejection of the situation and dwelling on negative factors.

Many of the controls had risen above a difficult background. One control case was exposed to poverty, an alcoholic stepfather and frequent moving about. He had a capacity to make friends and to get much satisfaction from his human contacts. He did not feel resentful or feel that the world owed him a living but rather dealt with his problems and the challenges of life by developing mutually dependent relationships with friends and by keeping busy, active and interested.

Another man who was raised in an orphans' home, where the food was meager, stated that he enjoyed his experiences in meeting others. He became a member of the school band and gained much satisfaction from his activities. Another expressed his philosophy of life as follows: "A person has got to learn to do things for himself. If he can't he gets up against it and needs help."

A number of the controls attributed their good army adjustment to keeping interested and occupied and making the best of every situation. There was considerable emphasis on the importance of friendship. One man commented, "You act right and treat others right and they treat you right. That's the only way you find a friend. Sometimes you meet a fellow that has some of your hobbies or the things you like, and you make a friend that way."

In contrast, the schizophrenics stressed the worst aspects of people and situations. The schizophrenics were prone to consider themselves misassigned if they did not like th

work even though they had been trained for the job. They stressed the deficiencies of their officers and fellow soldiers. Their difficulties in forming close, warm, human contacts frequently led them to feel closer to nature, inanimate objects or animals than to other people.

Discussion

The subjects of the present study who were observed in a schizophrenic episode overseas did not appear to differ in any recognizable way from civilian schizophrenic patients. Their personalities and backgrounds fit strikingly the description of Campbell (2) and the statistical evaluation of the personality background and characteristics of patients with schizophrenia made by Bowman and Raymond (1). Neither did the course of illness we observed differ from civilian schizophrenia. However, perhaps because of the fact that their environment could be changed by evacuation to the United States and discharge from the service, a larger percentage of the patients could be returned to life outside the hospital.

The authors are inclined to the view that schizophrenia is analogous to diabetes in the sense that the adaptive defect is always present although the patient may be compensated and therefore asymptomatic. The disorder commonly becomes manifest when, under appropriate stress, the precarious balance breaks down. The 341 schizophrenics who were the subjects of this study decompensated and became overtly psychotic in a combat zone in the Southwest Pacific area in World War II in the sense that they displayed aberrant thinking and behavior which made it impossible for them to continue on duty. Virtually all of them, however, gave evidence of a life-long tendency to react to problems and challenges in day-to-day life in a seclusive and disorganized way. Their tendencies were in marked and statistically significant contrast to the healthy controls. After discharge from military service a few of the schizophrenics remained frankly psychotic. Most of the others continued to display symptoms of poor adjustment and minor schizoid manifestations. Again the control group differed in a very clear-cut way.

Comparison between the schizophrenic and the control groups revealed many marked differences prior to, during and after military service. Particularly noteworthy were the capacity of the control group to gain more satisfaction from the situation in which they found themselves, capacity to deal with frustration in planning and finding solutions for problems and more realistic aspirations. In contrast, the schizophrenic group lacked the capacity to gain satisfaction especially in interpersonal relationships but also in work and recreation. There was a lack of capacity to organize and plan and to use a modicum of judgment in working out a satisfactory life adaptation. In no instance in the control group had an overt psychiatric illness developed. However, one had developed hypertension and another, a peptic ulcer. In numerous instances the schizophrenics showed a functional incapacity to use normal intellectual function, as manifested by their poor judgment, lack of grasp of situations and defective capacity for making abstractions.

It is not implied in this communication that the military setting in a combat zone on an isolated tropical island in wartime is necessarily more stressful for any individual than is his usual civilian setting. It was obviously stressful for a great many schizophrenics but, as Fry has pointed out, the army with all of its disagreeable aspects may become a comfortable and secure haven for others (3). He studied the military records of a group of former Yale and Harvard students who had had psychiatric care while at college and who would have been considered by their psychiatrists as unfit for military duty. The performance in the service of these men was roughly comparable to that of the general population, and the rate of discharge for psychiatric disability was no greater among the former psychiatric patients. This raises the question as to the desirability of attempting to screen out at induction any but the already grossly psychotic individuals.

The events which appeared to be important in precipitating the acute illness among the patients we observed also occurred with equal frequency among the control group. The character of the event itself did not seem to be so significant as did its meaning to the individual concerned in view of his earlier conditioning and his capacity to adapt to difficulties. Many schizophrenics had carried on successfully for

long periods of time under adverse conditions when there was a high degree of motivation or will to serve. It appeared, therefore, that the morale rather than degree of psychopathology frequently determined whether an individual was able to continue to give useful service or broke down and had to be hospitalized.

Many patients gave evidences of an impending psychotic reaction. Had they been treated, evacuated or perhaps reassigned before the severe psychotic symptoms developed, they would have been less of a hindrance to those fighting a war. Many were sent back to duty from hospitals when it was evident that they could not be of value to their organizations. From the standpoint of the morale of the others and discouraging widespread hospitalization, a certain amount of pressure on those who were not well adapted may be desirable, particularly when there is a manpower shortage as there was during most of the Pacific war. An effort has to be made to utilize every man to the fullest advantage and to discourage those who might tend to enlarge upon their symptoms and thereby escape from their tasks. However, differences in ability and capacity for adaptation preclude complete justice and equality in assignment of duties. Those with the greatest capabilities must necessarily bear more of the burden of responsibility and sacrifice.

The man with hysterical or hypochondriacal symptoms, which were often precursors of an overt schizophrenic disorder, could no more carry on than the man with a wounded leg. However, he built up counter-resentment in the men in his organization and often in the medical officers. The hostility engendered caused further hostility in the patient. An understanding but firm attitude might not do away with the symptoms in such an individual, but it might lessen antagonism and increase capacity to give some service.

The fact that a large number broke down after they had been overseas for some time may indicate that whenever feasible the army should attempt to return soldiers to the United States after some definite period, such as 18 months. Knowing that there is to be relief from the strain of an unusual setting overseas after a specific length of time may serve as a goal and be a stimulus to tolerating hardship.

Among the patients whom we observed, many had recovered from their acute episode prior to their evacuation to the United States. We were able to use the services of these men in the hospital complement while they were awaiting transportation. According to their training, some worked as cooks, some as laborers and some as clerk typists. Several of these men were reluctant to give up their useful work and return to the United States as incompetents. It was our impression that the rehabilitation of these men would have been more satisfactory if they had been reassigned to appropriate duty, avoiding the demoralizing effects of return to the mainland for automatic medical discharge with its inevitable, attendant stigma.

Summary and Conclusions

A group of 341 patients with acute schizophrenic reactions treated in a combat zone overseas were followed up 5 to 8 years later. Despite removal from the environment in which the illness occurred and discharge from the service, 51 of the patients had to be re-hospitalized for their psychosis; 186 of the patients were still considered to be moderately or markedly disabled by their mental illness 5 or more years after the original episode. These findings would appear to contradict the widely held notion that these "acute battle reactions" are of a relatively benign and transitory nature. In fact, the illness does not seem to differ significantly from schizophrenia encountered in civilian life.

It is to be noted that neither the military nor the domestic experiences of the schizophrenic patients differed significantly from those of the control group. Because the tabulation of differences between the two groups was subject to considerable human error, relatively rigorous standards were set for the statistical analysis. Chi-square was made equal to 6.4 in a fourfold table, and only figures significant to the one per cent level were included in the tables.

The figures show that while the backgrounds and experiences of the schizophrenic and control groups are strikingly similar, the two groups differ greatly with respect to personality and behavior patterns prior to illness. There was an inconsistency and lack of organization about the early lives of the schizophrenic pa-

tients, with a prominent lack of productive and satisfying relationships with other individuals and groups of individuals.

The greatly increased incidence of homesickness among the schizophrenic group prior to illness was indicative of their lack of capacity to build emotionally-nourishing contacts with people.

Following discharge from the army their characteristically disorganized way of dealing with life has continued among the schizophrenic group, leading to a poorer general family and social adjustment than before induction. A fourth of them were still livng with their parents and over half were irregularly employed. In contrast, the control group achieved a better general adjustment in their more mature years upon becoming reestablished in civilian society. Ninety per cent were living with their wives and all of them were steadily employed.

The above findings lead to the inference that an acute schizophrenic illness is an accentuation of attitudes and reactions which are characteristic of the individual's previous personality. It represents the decompensation of a brittle pattern of adjustment characterized by insulation from people and unrealistic aims and an inconsistent way of achieving them. Schizophrenia becomes a way in which those of a given temperament "decompensate" in the face of excessive demands on their integrative capacity. Factors responsible for these temperamental differences among individuals are beyond the scope of this study.

In the judgment of the authors based on a careful study of a group of schizophrenic casualties in World War II, the following suggestions to the military service are offered:

1. There is little profit in attempting to screen out potential schizophrenics at the induction station because a) an adequate review of attitudes, reactions and past performance would be unduly elaborate and costly, and b) the experiences of military life for any single individual might prove less stressful than those of his civilian setting.

2. Battalion surgeons and others who come in close contact with "decompensating" soldiers should be made aware of impending signs of schizophrenic breakdown so that difficult-to-manage catatonic episodes might be avoided. It is even possible that some adverse pressures in an organization might be corrected by the good offices of a medical officer who observes carefully and skillfully the emotional climate of his unit. Moreover, positive efforts to promote high morale and the satisfaction of effective service might also reduce the incidence of breakdown.

3. In the event of a schizophrenic breakdown, it is suggested that hope not be abandoned for rehabilitating the individual for further useful service.

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FURTHER IMMUNOLOGICAL AND CLINICAL STUDIES ON THE IMPORTANCE OF A NEUROTROPIC STREPTOCOCCUS IN THE ETIOLOGY OF EPIDEMIC POLIOMYELITIS AND ITS RELATION TO THE NATURAL VIRUS

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It is the purpose of this communication to report the results obtained in a further study by new methods of epidemics of poliomyelitis, including persons having mild and severe paralytic poliomyelitis soon and long after onset of the disease and of well non-contact persons residing within and remote from epidemics of poliomyelitis.

Results of previous studies, indicating causal relationship of a specific type of streptococcus to epidemic and experimental poliomyelitis and to the "virus" have been reported from time to time since 1916 when the specific type of streptococcus of poliomyelitis was first isolated (5, 6, 7). The diagnostic and epidemiological importance of cutaneous reactions following intradermal injection of natural and of thermal poliomyelitis streptococcal antibody and of antigen have been reported on more recently (8, 9).

Methods for the specific mass prevention and treatment of epidemic poliomyelitis from studies of the virus are still non-existent. The need therefore for further reports on combined studies of the specific type of streptococcus and the virus is indicated.

The opportunity to make the present additional study of a major epidemic of poliomyelitis was made possible through the cooperation of Drs. John O. Beatty and Wm. A. O'Brien of Reno, Nevada. The epidemic for which they sought assistance was by far the worst that had occurred throughout the sparsely inhabited state of Nevada. It began in early summer, 1952 and extended through summer and the unusually warm autumn and winter into January, 1953.

The epidemic was characterized by a high incidence of bulbar poliomyelitis and by an unusually high occurrence in adults as has been true of the epidemics also studied in Cailfornia, Minnesota and Ohio. The diagnosis by spina puncture and treatment by tracheotomy an respirator care as indicated in bulbar cases b the "poliomyelitis team" at the Washoe Medica Center of Reno, Nevada was excellent and th mortality rate of 18 per cent was unusuall low considering the high incidence of bulba cases. No new cases occurred for 7 days durin my studies in Reno from January 28 to Febru ary 4, 1953. The active cases studied were patients cared for in the Washoe Medical Center and those that were convalescent had gone home and kindly returned for the cutaneous tests.

Methods of Study

Cotton, wrapped on flexible aluminum wire and bent to a suitable angle, was used to make nasopharyngeal swabbings, without touching the tongue, in patients having severe paralytic poliomyelitis and in whom the cutaneous reaction indicating streptococcal antigen was large. The swabs which had adsorbed the material were immediately replaced in narrow test tubes and several drops of a glycerine-NaCl menstruum[2] were added to prevent growth of contaminating bacteria and to preserve viability and specificity of the streptococci during airplane transit to the laboratory at Longview Hospital, Cincinnati, Ohio for cultures and other tests.

Serial dilution cultures at steps of 10^{-4} were made in dextrose brain broth. The streptococcus that grew in pure culture at the end point of growth, usually at 10^{-6} or 10^{-10}, was subcultured into tubes of dextrose brain broth. Then 10 ml. of such culture was in turn inoculated into previously warmed gallon lots of 0.2 per cent dextrose broth and incubated 18 to 24 hours at 35°C. These mass cultures of streptococci were harvested in a continuous feed

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[2] This solution was used throughout these studies. It contains two parts glycerine to one part saturated NaCl solution and is autoclaved prior to use.

centrifuge and suspended in a glycerine-NaCl menstruum in a concentrate of 1000 billion organisms per ml. and placed in the refrigerator at 10°C. for future preparation of vaccine and antibody. Viability is thus maintained for months and specific antigenicity almost indefinitely.

The thermal antibody for cutaneous tests and for treatment was prepared by diluting glycerine-NaCl streptococcal suspensions with isotonic saline to a concentration of 20 billion cells per ml. These cells, which had been isolated in epidemic and experimental poliomyelitis, were then autoclaved at 17 lbs. for 96 hours. The resulting bacteria-free supernate was diluted with equal volume of sterile isotonic saline solution containing a phenol preservative (10).

Thermal antibody was prepared in a like manner from streptococci isolated in studies of arthritis and respiratory infections and used as controls. Thermal antibody used in treatment was also prepared by autoclaving for 3 hours at 17 lbs. pressure; the NaCl solution suspensions containing 10 billion streptococci per ml. from the respective dense suspensions in glycerine-NaCl solution after adding 1.5 per cent hydrogen peroxide, bringing the reaction to pH 7.0 with sodium hydroxide (11). The streptococcal antigen for the cutaneous tests, previously shown to indicate specific antibody, consisted of the bacteria-free supernatant of an isotonic saline suspension of 10 billion streptococci per ml. heated at 70°C. for one hour.

The diagnostic cutaneous tests for specific streptococcal antigen in skin or blood were made routinely by injecting intradermally approximately .03 ml. of thermal antibody and for antibody by injecting .03 ml. of the corresponding antigen. The almost immediate transient erythematous non-itching reactions which occurred following such injections were outlined with pen and ink and recorded in sq. cm. by matching circles of predetermined size on transparent 5 x 6″ films of cellophane. The respective convalescent serums were pooled, according to the size of the cutaneous reactions indicating antibody, for agglutination studies.

To determine the localizing and disease-producing properties of the streptococci, adult and young mice weighing approximately 30 and 10 grams respectively were inoculated cerebrally, intravenously, nasally and orally with streptococci isolated from nasopharyngeal swabbings at the end point of growth in serial dilution cultures in dextrose brain broth. Routinely, .03 ml. of such cultures of a 20/1 suspension in NaCl solution was inoculated intracerebrally while the mice were under ether anesthesia. Additional mice were injected intravenously in a tail vein with .5 ml. of dextrose brain broth cultures per 10 grams of body weight. The cultures inoculated represented streptococci freshly isolated from nasopharyngeal swabbings or from dense suspensions of pure cultures of groups of strains isolated in studies of epidemic and experimental poliomyelitis and from outdoor air of the epidemic and as controls from other sources that had been preserved by partial dehydration in the glycerine-saturated NaCl menstruum at 10°C. for from a few days to 7 months.

Results of Cutaneous Tests with Streptococcal Thermal Antibody and Antigen

The cutaneous tests, conducted in Reno in persons with severe paralysis long after onset, resulted in a new find indicating poliomyelitis streptococcal antigen in very high titer and antibody in very low titer months after onset of severe paralysis. This impelled me to determine if possible whether such excessive antigen and deficient antibody in severe paralytic poliomyelitis of long standing is common. If so, perhaps poliomyelitis streptococcal thermal antibody given intramuscularly or intravenously might function as would natural antibody which such patients, for reasons still obscure, seemingly do not produce in adequate titer.

Through giving a lecture on poliomyelitis at Dr. Charles Baker's invitation at the Merritt Hospital, Oakland, California, the privilege of making such tests on patients having severe paralytic poliomyelitis long after onset in the Hyland Alameda County Hospital, Oakland was granted by Dr. Otis Whitecotton, Superintendent; by Dr. E. B. Shaw of the Children's Hospital, San Francisco; by Dr. Albert Bower of the Contagious Disease Hospital, Los Angeles; by Dr. John A. Affeldt of Rancho los Amigos, Hondo, California and by Dr. Archibald Hoyne of the Cook County Contagious Disease Hospital, Chicago, Illinois.

The results of the cutaneous tests made in

TABLE 1—SUMMARY OF CUTANEOUS REACTIONS IN PERSONS HAVING EPIDEMIC POLIOMYELITIS TO INTRADERMAL INJECTION OF POLIOMYELITIS STREPTOCOCCAL THERMAL ANTIBODY AND OF ANTIGEN

*Persons Having Poliomyelitis That Were Studied: 1952-1953**	*Average Duration of Disease at Time of Skin Tests*	*Persons tested*	*Erythematous Reactions in Sq. Cm.* to Intradermal Injection of Thermal Antibody and of Antigen Prepared from Streptococci Isolated in Studies of*				
			Epidemic Poliomyelitis			*Polio passage virus*	
			Thermal antibody	*Antigen*	*Antibody-antigen ratio*	*Thermal*	*Arthritis antibody*
Without paralysis		15	11.05	16.95	1.53	7.07	3.14
With slight paralysis.....	15 *days to*	21	12.09	13.43	1.11	11.56	1.91
With moderate paralysis	10 *months*	14	14.46	7.07	0.45		2.19
With severe paralysis	15 *days to* 46 *months*	27	14.12	3.07	0.22		1.41

* It is presumed that the erythematous reaction to the intradermal injection of antibody indicates the presence in skin or blood of antigen and injection of antigen; the presence of antibody. This presumption seems valid because the size of the reactions to antibody in persons ill was proportional to the severity of the disease and in reverse to antigen.

persons having or who had recently recovered from poliomyelitis according to the duration and degree of paralysis are summarized in table 1. It will be seen that the average size of the cutaneous reactions indicating poliomyelitis streptococcal antigen in skin or blood following intradermal injection of antibody prepared from streptococci isolated in studies of epidemic poliomyelitis and from passage poliomyelitis virus was in direct proportion to the degree of paralysis. Contrarywise, reactions indicating poliomyelitis streptococcal antibody following injection of the poliomyelitis streptococcal antigen were in reverse proportion, being far greater in persons without paralysis than in persons severely paralyzed. The antibody-antigen ratio was sevenfold greater in persons who recovered without paralysis than in persons severely paralyzed. The average duration of the disease in the group severely paralyzed was far longer than in the other groups and the antigen titer remained high while antibody titer diminished progressively according to the duration and degree of paralysis. Reactions to thermal antibody prepared from the streptococcus isolated from poliomyelitis passage virus in persons having poliomyelitis without or with slight paralysis were only slightly less than to antibody prepared from the streptococcus isolated in epidemic poliomyelitis. Moreover, the antibody titer in persons severely paralyzed, not shown in the tables, long after onset that were improving was significantly greater than in similar cases that were not improving.

The results of intradermal injection of thermal streptococcal antibody and of antigen in control well persons residing in Reno, in persons having chronic arthritis, current respiratory infection, in persons having idiopathic epilepsy at the Nevada State Hospital, just outside Reno, and in well persons remote from poliomyelitis are summarized in table 2. It will be noted that the cutaneous reactions indicating poliomyelitis streptococcal antigen in skin or blood were abnormally high but not as great as in persons stricken in the different groups whether in direct contact or not, except persons having epilepsy and well persons in Cincinnati remote from epidemic poliomyelitis in whom the reactions were within the normal range. Cutaneous reactions in each group of well contacts and non-contacts living in the epidemic zone to the poliomyelitis streptococcal antibody indicating antigen were consistently less than to antigen indicating antibody. The average reaction in the 88 well persons tested indicating antigen was 9.70 sq. cm. and the reaction indicating antibody was 13.50 sq. cm. The antibody-antigen ratio was similar to that of the group of persons that recovered from poliomyelitis without residual paralysis (table 1). Reactions in poliomyelitis contacts to thermal antibody

TABLE 2.—ERYTHEMATOUS REACTIONS IN WELL CONTACTS AND NON-CONTACTS AND IN PERSONS HAVING ARTHRITIS, RESPIRATORY INFECTION OR EPILEPSY TO INTRADERMAL INJECTION OF STREPTOCOCCI THERMAL ANTIBODY AND ANTIGEN

Groups	Number of Persons Tested	Erythematous Reaction* in Sq. Cm.* to Intradermal injection of Thermal Antibody and of Antigen Prepared from Streptococci Isolated in Studies of					
		Epidemic poliomyelitis		Polio-passage virus	Arth-ritis	Resp. inf.	Epilepsy
		Thermal antibody	Antigen	Thermal antibody			
Persons living in epidemice zones: Nevada, California and Illinois							
Physicians, nurses and attendants that had been exposed to poliomyelitis for							
2-5 months	21	10.86	10.76	6.56	2.24		
7 mos. to 2 yrs.	15	8.03	16.14	9.28	2.59		
3-8 years	15	8.49	15.49	8.17	2.59		
Parents of children stricken	14	11.84	13.93		1.88		
Not exposed to poliomyelitis: That were well	23	9.73	12.13		2.76		
That were having Arthritis	10	10.09	8.2		8.76		
Respiratory Infection	15	9.06			4.40	14.60	
Idiopathic epilepsy†	21	2.67			1.22		15.82
Control well persons remote from poliomyelitis in Cincinnati, Ohio.	15	4.57	3.47	2.74	2.63	4.18	

*See footnote, table 1.
†Patients at the Nevada State Hospital, Reno, Nevada.

prepared from the streptococcus isolated from poliomyelitis passage virus indicating antigen were nearly as large as to antibody prepared from the streptococcus isolated in studies of epidemic poliomyelitis, striking example indicating a basic similarity of the streptococcus of epidemic and experimental poliomyelitis. Reactions indicating poliomyelitis streptococcal antibody in well contacts and non-contacts residing in the epidemic zone paralleled or were in excess of reactions indicating antigen and increased strikingly with the duration and degree of exposure and were significantly less in non-contact persons having arthritis. Reactions to intradermal injection of poliomyelitis streptococcal antibody indicating poliomyelitis streptococcal antigen in persons having respiratory infection and living in the epidemic zone paralleled that of well contacts and non-contacts. Reactions in these were minimal to arthritis and maximal to respiratory streptococcal antibody. Reactions to the poliomyelitis streptococcal antibody in institutionalized persons having idiopathic epilepsy and among whom poliomyelitis had not occurred were far less than in contacts and non-contacts of the civilian population. Nurses and attendants of the hospital who frequented Reno reacted similarly to non-contacts living in Reno. Reactions in persons having epilepsy were also minimal to the arthritis antibody and by far greatest to the thermal antibody prepared from streptococci isolated in studies of idiopathic epilepsy. Reactions in well control persons in Cincinnati, Ohio remote from poliomyelitis approximated the normal range.

Cutaneous reactions to intradermal injection of poliomyelitis streptococcal antibody indicating antigen in persons having epidemic poliomyelitis, in well persons and in persons having respiratory infection in Minnesota, Ohio and

TABLE 3.—Erythematous Cutaneous Reactions to Intradermal Injection of Thermal Antibody Prepared from Streptococci Isolated in Studies of Epidemic and Virus Poliomyelitis, Respiratory Infection and Arthritis in Relation to Epidemic Poliomyelitis and Respiratory Infection.

Groups	Cases	Erythematous Reactions in Sq. Cm.* to Intradermal Injection of Thermal Antibody Prepared from Streptococci Isolated in Studies of						
		Epidemic poliomyelitis			Poliomyelitis virus		Resp. inf.	Arthritis
		4277 (1946, 7, 8)	8122 (1951)	8123 (1952)	Mouse 8379	Monkey 8380		
Persons having epidemic poliomyelitis, summer, autumn, 1952.								
Ancker Hospital, St. Paul, Minn.; Mercy Hospital, Hamilton and General Hospital, Cincinnati, Ohio	27	10.45	12.53	10.63	11.67†	12.26†		3.89
General Hospitals, San Bernardino and Los Angeles, Calif.	13	15.90			15.63	15.05		4.29
Well persons.								
In summer during prevalence of poliomyelitis	38	8.38	9.62	7.13			4.28	3.40
Remote from poliomyelitis	17	2.80	2.75	3.69				1.95
In autumn during prevalence of poliomyelitis and respiratory infection	8	10.25					11.19	2.45
Persons having respiratory infection.								
Autumn during prevalence of poliomyelitis	36	11.15					16.67	2.67
Remote from poliomyelitis	20	3.21					15.28	3.14

* It is presumed that the erythematous reaction to intradermal injection of antibody indicates the presence in skin or blood of corresponding antigen.

† Average for 4 cases.

California in the summer and autumn of 1952 are summarized in table 3. The reactions to 3 thermal antibody solutions prepared from streptococci isolated in studies of epidemic poliomyelitis, to 2 specimens of thermal antibody prepared from streptococci isolated from the Lansing strain of poliomyelitis passage virus were comparable.

Cutaneous reactions indicating circulating poliomyelitis streptococcal antigen in well noncontact persons in summer, 1952 in Minnesota, Ohio and California during the general prevalence of poliomyelitis were moderately high and comparable to those obtained in Nevada and California. Reactions indicating antigen in well persons remote from poliomyelitis were negligible. Reactions in well persons to antibody prepared from streptococci isolated in studies of poliomyelitis and respiratory infection respectively were moderately high and ran closely parallel in autumn during the general prevalence of both poliomyelitis and respiratory infections. During this same time persons having respiratory infection reacted moderately to the poliomyelitis antibody and maximally to the respiratory antibody whereas persons having respiratory infections after poliomyelitis had disappeared reacted maximally to the respiratory streptococcal antibody and insignificantly to poliomyelitis streptococcal antibody.

A summary of the cutaneous reactions obtained on intradermal injection of poliomyelitis streptococcal thermal antibody in 1953 in two groups of persons with residual paralysis and a control group that had not had poliomyelitis are depicted in table 4. It will be seen that the reactions to thermal antibody indicating poliomyelitis streptococcal antigen in persons that had recovered from poliomyelitis a short or a long time before and in the contact physicians were uniformly large and comparable. Whereas in well persons, and persons that had schizo-

TABLE 4.—Results of Cutaneous Tests with Poliomyelitis Streptococci Thermal Antibody Indicating Circulating Antigen and with Poliomyelitis Streptococci Antigen Indicating Circulating Antibody

Group and Condition at Time of Tests	*Cases*	*Avg. age yrs.*	*Erythemaeous Cutaneous Reactions, Sq. Cm., Indicating in Skin or Blood of Circulating Poliomyelitis Streptococcal*		*Control Reactions to "Arthritis" Thermal Antibody*
			Antigen	*Antibody*	
Persons that had poliomyelitis in 1953, 2 to 5 months before					
Slight residual paralysis	10	14	11.25	15.08	4.5
Severe residual paralysis	10	13	8.16	5.63	3.41
Persons that had poliomyelitis 5 months to 13 years before					
Slight residual paralysis	6	12	8.41	13.22	3.60
Severe residual paralysis	7	16	8.98	5.55	2.67
Contact physicians	3		8.08	10.14	3.21
Control persons not having had poliomyelitis					
Well	8	15	4.05	3.73	2.89
Having schizophrenia	11		2.22	2.21	1.33

phrenia, such reactions were far smaller. Reactions to intradermal injection of the streptococcal antigen indicating circulating antibody were far greater in persons having slight paralysis than is those with severe residual paralysis and than in well control persons and than in those having schizophrenia. Reactions to arthritis streptococcal antibody indicating circulating arthritis streptococcal antigen were uniformly within the normal range.

Results of Therapeutic Injection of Thermal Antibody

Intramuscular therapeutic injection of thermal antibody in persons having paralytic poliomyelitis at the Washoe Medical Center, Reno, Nevada caused a sharp drop in 72 hours in reactions to repeat intradermal injection of thermal antibody indicating circulating poliomyelitis streptococcal antigen and an increase in reactions to intradermal injection of antigen indicating antibody in each of the 7 persons tested. The average of reactions indicating antigen before therapeutic injection was 19.14 sq. cm.; after such injection 10.98 sq. cm. The average reaction indicating antibody before such therapeutic injection was 10. 01 sq. cm. and after such therapeutic injection 17. 07 sq. cm. In several of the patients the clinicians reported an increase in muscle function in parallel with the diminution of circulating streptococcal antigen and an increase in circulating antibody. The agglutinative titer of the respective serums for the poliomyelitis streptococcus increased in parallel with a diminution in cutaneous tests indicating circulating antigen and an increase in reactions indicating antibody.

Through the cooperation of Dr. E. L. Robinson of Mercy Hospital, Hamilton, Ohio, I have had the opportunity of making nasopharyngeal swabbings, cutaneous tests and agglutinative studies with the serums of persons having epidemic poliomyelitis before and after therapeutic intravenous injection of the poliomyelitis streptococcal thermal antibody.

Serial dilution cultures in dextrose brain broth at steps of 10^{-2}, 10^{-6} and 10^{-10} were made of the nasopharyngeal swabbings before and 24 or 48 hours after such treatment in 16 persons in the early stages of epidemic poliomyelitis. The streptococcus was isolated at dilutions of 10^{-2} and 10^{-6} in all of the 16 swabbings and at 10^{-10} in the swabbings of 8 persons before antibody treatment. Of the repeat 16 swabbings, 24 to 48 hours after the intravenous therapeutic injection of the poliomyelitis streptococcal antibody, all cultures were free from the streptococcus in 7 and streptococci grew from but 9

TABLE 5.—Localization in the Brain and Spinal Cord and the Occurrence of Weakness and Paralysis in Mice Following Intravenous, Intracerebral and Oral Inoculation of the Streptococcus from the Nasopharynx of Persons Having Poliomyelitis, from Poliomyelitis "Virus", from Outdoor Air in the Epidemic Zone of Poliomyelitis and Localization in the Lungs of Mice Isolated from the Nasopharynx of Persons Having Respiratory Infection and from Outdoor Air Zones of Epidemic Respiratory Infections

Material Inoculated: Non-hemolytic Streptococci from	*Method of Inoculation Intra-*	*Summary of Experiments in Mice*						
		Number inoculated	*Duration of experiments in days*	*Per cent Having weakness or paralysis*	*That died*	*Isolation of the Streptococci from Brain*	*Spinal cord*	*Lungs*
Nasopharynx of persons having epidemic poliomyelitis	*Venous*	39	1	69	29	77	82	31
	Cerebral	17	1	79	63	100	100	19
Lansing poliomyelitis virus after storage in 50% glycerin at 10°C. for 6 years.	*Venous*							
Adapted to the Monkey		13	1	62	23	77		38
Adapted to the Mouse		4	1	100	50	100		
Outdoor air atop a fourteen story building in epidemic zone of poliomyelitis, Reno, Nevada	*Venous*	10	1	60	0	100	100	30
	Cerebral	13	1	62	29	92	100	38
Nasopharynx of persons having respiratory infection and from outdoor air in zones of epidemic respiratory infection.	*Venous*	14	1	0	0	29	14	78
	Cerebral	12	1	0	0	17	25	67
Nasopharynx in persons having epidemic poliomyelitis, suspended in		6	3	0	0	33	50	0
Isotonic NaCl solution	*Oral*	5	3	0	0	40	80	40
Poliomyelitis streptococcal thermal antibody		5	3	0	0	0	20	20
Nasopharynx in epidemic respiratory infections suspended in		6	3	0	0	0	0	83
Isotonic NaCl solution	*Oral*	5	3	0	0	0	0	100
Respiratory streptococcal thermal antibody		5	3	0	0	0	0	20

swabbings at serial dilution of 10^{-2}, one at 10^{-6} and no growth occurred in dilutions at 10^{-10}. A similar but less striking diminution in the number of streptococci in nasopharynx occurred in other persons having poliomyelitis following intramuscular injection of the poliomyelitis streptococcal antibody. The diminution of streptococci in the nasopharynx, clincial improvement and diminution of antigen and increase in antibody ran closely parallel. As further proof that the disappearance or diminution of the streptococcus was due to the administration of thermal antibody, it should be stated that the results of the first swabbings were in accord with those obtained in many other similar cases of epidemic poliomyelitis, and no such abrupt diminution and absence of streptococci on repeat swabbings occurred in persons having poliomyelitis not receiving thermal antibody.

Agglutination Experiments

A consistently greater agglutination of the streptococci isolated in studies of epidemic and experimental poliomyelitis was obtained with the serums of poliomyelitis patients and contacts having cutaneous reactions indicating a high titer of antibody than from poliomyelitis patients, well contacts, and non-contacts having cutaneous reactions indicating a low titer of antibody. The agglutinative titer for the strep-

tococcus greatly increased in paralytic poliomyelitis following repeat intramuscular injection in therapeutic amounts in treatment and as clinical improvement occurred. Agglutinations of streptococci from arthritis, encephalitis and multiple sclerosis were negligible. Streptococci from respiratory infection were agglutinated significantly in accord with cutaneous reactions to intradermal injection of respiratory streptococcal antigen but which was obtained as the seasonal incidence of respiratory infections supervened and as the epidemic of poliomyelitis disappeared. Streptococci isolated in studies of epidemic poliomyelitis and of poliomyelitis passage virus were agglutinated specifically by poliomyelitis antistreptococcal horse serum and crosswise by their respective thermal antibody solutions. The streptococci isolated in studies of arthritis were agglutinated specifically by the arthritis antistreptococcal horse serum and by arthritis streptococcal thermal antibody solution.

Experiments in Mice

The effects in altogether 154 mice following intravenous, intracerebral and oral inoculation of the streptococcus isolated from the nasopharynx of persons having poliomyelitis, from poliomyelitis "virus" and from outdoor air in the epidemic zone of poliomyelitis and as a control from the nasopharynx of persons having respiratory infection and from outdoor air in epidemic zones of respiratory infection are summarized in table 5.

The occurrence of weakness or paralysis, deaths and isolations of the streptococci from the brain and spinal cord were far greater following intravenous and intracerebral inoculations of the streptococci from the nasopharynx of persons having epidemic poliomyelitis, from poliomyelitis virus and from outdoor air in the epidemic zone of poliomyelitis than following similar inoculations of streptococci isolated from the nasopharynx of persons having respiratory infections and from outdoor air in zones of epidemic respiratory infections. Isolation of streptococci from the lungs of inoculated mice was far greater than from the brain and spinal cord in the latter group.

Interestingly, the incidence of weakness and paralysis and of isolations of streptococci from the spinal cord of young mice (not shown in the table) was two- to three-fold greater than in adult mice receiving weight for weight the same number of streptococci isolated from the nasopharynx of persons having epidemic poliomyelitis, paralleling respectively the incidence of poliomyelitis according to age in human beings.

In the experiments following oral inoculation, there were no deaths and no evidence of weakness or paralysis, but the incidence of isolations of the streptococcus from the brain and spinal cord was high and far less from lungs in mice exposed to the NaCl solution suspension of the streptococcus from the nasopharynx of persons having epidemic poliomyelitis and negligible on exposure to the same streptococci suspended in the poliomyelitis streptococcal thermal antibody. The streptococcus was not isolated from the brain and spinal cord of mice that were exposed to NaCl suspensions of the streptococcus isolated from the nasopharynx of persons having respiratory infections, whereas isolations from the lungs were high in 2 groups of mice and negligible in mice similarly exposed to the same streptococci suspended in the respiratory streptococcal thermal antibody.

Furthermore, the subcutaneous injection of 1 ml. of the poliomyelitis and respiratory thermal antibody into mice 24 hours before they were made to respire and to eat and drink the respective streptococci (not shown in the table) protected against localization of the streptococci in the brain and lungs respectively compared to the localization in the control mice that had received subcutaneous injection of NaCl solution.

Summary and Comments

The cutaneous reactions to intradermal injection of poliomyelitis streptococcal thermal antibody indicating circulating poliomyelitis streptococcal antigen were found negligible in well persons remote from epidemics of poliomyelitis, uniformly fairly large in well contacts and non-contacts living in epidemic zones, larger in persons having mild poliomyelitis and largest and in direct proportion to the degree, duration and non-improvement of paralysis in paralytic poliomyelitis.

Reactions indicating specific circulating streptococcal antigen on intradermal injection of thermal antibody prepared from the streptococcus isolated in studies of experimental or

"virus" poliomyelitis, in persons having poliomyelitis (tables 1 and 3) and in well contacts (table 2) were comparable to those obtained with thermal antibody prepared from streptococci isolated in studies of epidemic poliomyelitis. The respective streptococci were alike in morphology, agglutinability (table 2) and in their neural localization on intravenous injection of mice.

Reactions indicating streptococcal antibody to intradermal injection of poliomyelitis streptococcal antigen in persons having poliomyelitis were in reverse order being greatest in persons having poliomyelitis without paralysis and were smaller in size in direct proportion to the degree and duration of paralysis in paralytic poliomyelitis. The antibody-antigen ratio in persons having poliomyelitis without paralysis proved sevenfold greater than in persons severely paralyzed long after onset of poliomyelitis.

Persons severely paralyzed, for reasons still obscure, seem to be unable to produce streptococcal antibody in adequate titer, and in consequence, poliomyelitis streptococcal antigen titer remains high, paralysis maximal and seemingly in consequence, recovery from paralysis delayed or prevented. Thus indicating perhaps a specific and not just a general physiological defect in severely paralyzed and fatal cases of poliomyelitis as suggested by Aycock (2) and emphasized by Anderson (1).

Agglutinative titer of poliomyelitis convalescent serum and the erythematous cutaneous reactions to intradermal injection of poliomyelitis streptococcal antigen indicating antibody ran closely parallel. Antigenic relationship of the virus and streptococcus was further indicated by the fact that convalescent serum neutralized the virus and agglutinated the streptococcus specifically.

Therapeutic intramuscular or intravenous injection of the poliomyelitis streptococcal antibody was followed promptly as shown in repeat tests by a decrease in erythematous cutaneous reactions indicating specific circulating streptococcal antigen and an increase in reactions indicating specific streptococcal antibody; by a striking diminution or temporary disappearance of the streptococcus from the nasopharynx and by an abrupt increase in agglutinative titer of the blood serum for the streptococcus and usually by a corresponding clinical improvement.

Moreover, the favorable results obtained in persons ill are in agreement with the diminution or disappearance in specific localizing properties of the streptococcus in mice when the streptococcus was treated previously to injection with thermal antibody and in agreement with the protective action in mice on intravenous injection of thermal antibody against localization of the poliomyelitis streptococcus. On the basis of these findings, it is suggested that the administration of the poliomyelitis streptococcal thermal antibody used with favorable results in the treatment of acute epidemic poliomyelitis (6, 7, 9, 3, 4) be extended to persons having severe paralytic poliomyelitis long after onset and who according to the cutaneous tests have antigen in excessive titer and, according to cutaneous and agglutinative tests, have antibody in deficient titer. The demonstrated high titer of antigen and especially of antibody in well contacts and non-contacts living in the epidemic zone and in persons that had recovered from poliomyelitis without residual paralysis is taken to indicate that high streptococcal antibody titer protects against paralytic poliomyelitis.

The streptococcus isolated in pure culture from outdoor air far above ground level remote from human beings, in the epidemic zone resembled the streptococcus isolated from nasopharynx of persons having epidemic poliomyelitis from passage "virus" and from outdoor air in other epidemics of poliomyelitis (12, 13) in morphology, staining reactions, growth requirements, agglutinablity and neurotropic virulence.

The results of combined studies of the filtrable virus and the specific type of streptococcus in both epidemic and experimental poliomyelitis indicate that what has been considered as the virus is but the small filtrable, mildly antigenic but highly invasive phase of the specific type of the non-filtrable, highly toxicogenic, antigenic, neurotropic alpha streptococcus. Exceedingly small spheres, ovoids and diplococcal forms sometimes in short chains have been demonstrated in unstained films in filtrates of the virus with the electron microscope by others and myself and by myself after special staining with the light microscope. Moreover, exceedingly small diplococcal forms "microdiplococci" free and as many as 40 of such forms in radial formation in the capsular substance of the

streptococcus suggestive of extrusions as grown in dextrose brain broth have been demonstrated after special staining with the electron microscope (14). That these minute diplococci are capable of growing into the mature streptococcus under favorable conditions may be the explanation as to why growth of streptococci in serial dilution cultures in dextrose brain broth often occurs in dilutions far greater than what would be possible from the mathematical calculations of the number of mature forms revealed by the light microscope.

In attempts to determine whether the small diplococcal forms which have been demonstrated in filtrates of poliomyelitis virus represent in fact the filtrable phase of the streptococcus and not a separate entity, rhesus monkeys were inoculated intracerebrally with filtrates of the virus and cultures were made in dextrose brain broth from such filtrates and from the spinal fluid. Pure cultures of the streptococcus were isolated from the filtrates in significant incidence in dextrose brain broth and no growth occurred in conventional mediums. The spinal fluid was found free from cells and bacteria and cultures were negative before and during the quiescent period of incubation but as fever, tremors and stacatto voice developed, but not yet paralysis, the streptococcus became readily demonstrable in appropriately stained films of the spinal fluid and was isolated in pure culture. This important finding has apparently been missed by investigators who have studied poliomyelitis from the purely virus standpoint. Then in the inoculated monkeys as in epidemic poliomyelitis, the streptococcus disappeared from the spinal fluid as paralysis developed, but was isolated consistently from and demonstrated in the lesions of the spinal cord after death.

It appears therefore that the primary infection in nasopharynx and perhaps in the intestinal tract in epidemic poliomyelitis is streptococcal in accord with the predominant occurrence of epidemics in summer when the streptococcus normally present in human beings and in nature tends to acquire neurotropic or poliomyelitis properties in temperate climates (15, 16). As such infection occurs, the "virus" or filtrable, highly invasive phase of the streptococcus may develop and which because extremely small penetrates the blood-brain-barrier where in turn it reverts in part into the highly toxicogenic, antigenic streptococcal phase as fever and symptoms of poliomyelitis develop.

The abnormally high incidence and deaths from poliomyelitis in adults during epidemics and the absence of neutralizing antibodies in their serum in the Arctic region as compared with that of adults during epidemics in temperate climates may be due to the absence of summer weather in the Arctic and hence the absence of sub-clinical but immunizing neurotropic streptococcal or viral infections which occur in human beings in summer in temperate climates.

The inexplicable or mysterious nature of the virus of poliomyelitis in which it has been held ever since discovered because filtrable and because of inadequate bacteriological methods in the light of these often repeated experiments, is no longer relevant for the virus has in fact been produced experimentally from the streptococcus and shown to be the small, filtrable, highly invasive, relatively non-antigenic phase of the much larger, highly toxicogenic, antigenic, neurotropic streptococcus (15, 16).

Poliomyelitis streptococcal vaccine and thermal antibody have been used successfully for the prevention of poliomyelitis in family groups (3), and monkeys have been immunized against inoculation of highly virulent virus with vaccine prepared from the poliomyelitis type of streptococcus (17).

It is suggested that vaccines prepared from the poliomyelitis streptococcus whose specificity is maintained be used for mass immunization instead of or concomitantly with the far more elaborate and costly current attempts with virus vaccines. Furthermore, in the light of the inadequacy of current therapeutic attempts to cure poliomyelitis, the use of the non-toxic, non-sensitizing, readily prepared poliomyelitis streptococcal thermal antibody should become routine for the treatment of epidemic poliomyelitis, including persons severely paralyzed long after onset of the disease provided in the latter group that the cutaneous tests indicate a high titer of circulating streptococcal antigen and a deficient titer of circulating antibody and for prevention of poliomyelitis in exposed family groups. Both of these materials could be made readily available in adequate amounts at minimal cost in individual and central laboratories.

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SOCIAL BEHAVIOR AND AUTONOMIC PHYSIOLOGY
A Sociophysiologic Study[1]

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INTRODUCTION

Research findings in the fields of both physiology and psychology have suggested that physiologic and psychologic behavior are interrelated, and that the concomitant relationships between them form the substance of a discipline, "psychophysiology". Autonomic physiologic components of "emotion", for example, have been investigated by many research persons (1, 9, 10) and with a variety of techniques (15). Earlier correlations of physiologis and psychologic variables were made from data gathered separately from each field. Recently data from the two disciplines have been taken simultaneously, e.g., with a polygraph which records physiologic changes with experimentally induced psychologic stress (8).

This step in methods constituted a major advance in the testing of wider areas of human activity, especially the study of "emotional states". However, now the problem of the definition and classification of emotions, as fear, anger, anxiety, and frustration, which had leaned heavily upon theoretical premises, could be restructured: the problem of *which* emotion gave way to the problem of *when* an emotion was present, as shown by con-comitant physiologic and psychologic changes. Thus, "emotional states" were empirically defined as psychophysiologic phenomena which emerged spontaneously in a human action situation. ("Emotion" which may be observed in relation to another person or within an action situation appears as a "more natural" type of phenomenon than that which was predicted from experimental inducement of an emotion (fear) when it was not known for certain that the emotion described was the same one felt.) (16) This study of "emotion" appeared more important than the definition, psychologically or physiologically of the "emotions".

The available method most adapted to the study of spontaneous affective states was one which considered "emotions" or "feelings" as they emerged in interpersonal relationships. Such a method was the Bales system of interaction process analysis. (2) Others were available but lacked either validity or practicability. The Bales system is defined below.

SOCIAL BEHAVIOR AND AUTONOMIC PHYSIOLOGY

In a few studies where psychology-physiology correlations were reported, strong implications appeared that social behavior changed in a meaningful way with psychophysiologic conditions (7). Recently, in an intensive cross-disciplinary study of schizophrenia, significant correlations were obtained between social action ("sociometric" method) and psychophysiologic states in patients (12). For example, patients who were more verbal, friendly, more organized and constructive in their social behavior showed, on psychologic tests, higher abstraction ability, and in the physiologic laboratory, reactions associated with benign prognosis. On the other hand, patients who were reticent, unfriendly and poorly organized in their social behavior, showed little abstraction ability and physiologic reactions associated with malignant prognosis.

Funkenstein and King, by a study of college students in an experimental stress situation, showed a significant relationship between anger expressed against the self (or "anxiety") and epinerphrine-like cariovascular reactions (11). In another study, King found a significant relationship between "perceived dominance of the father's discipline" and nor-epinerphrine-like cardiovascular reaction in experimental stress:

[1] This investigation was made possible by a fellowship grant from the Russell Sage Foundation.

These investigations were carried on at the Boston Psychopathic Hospital under the general direction of Dr. Harry C. Solomon, Superintendent of the hospital, and Professor of Psychiatry, Harvard Medical School, and with the guidance of Dr. Milton Greenblatt, Chief of Physiological Laboratories, Boston Psychopathic Hospital and Assistant Professor of Clinical Psychiatry, Harvard Medical School.

this study suggests also the possibility of a relationship between higher frequency of church attendance by the subject's parents and norepinerphrine-like cardiovascular reactions in experimental stress (13).

To test further for relationships between social behavior and autonomic nervous reactions, investigations were begun employing the simultaneous recording of physiologic variables and psychiatric interview material. These studies introduce an interdisciplinary area called "sociophysiology" whose methods and procedures are reported in this paper. The present study considers one patient in psychiatric interview therapy and is illustrative of the general direction of sociophysiologic investigations.

The Subject

The patient is 34 years old, married, and the father of two children. After two months of illness and a suicide attempt (slashed wrists, neck, stabbed chest) he was admitted to the hospital. Reports from his wife certify that for several years he had shown "odd" behavior. The patient felt that his co-workers were unfriendly and were "talking about him"; he was unable to adjust to his job situation (clerk) and was often "upset and anxious" facing the task of moving his family to a new residence.

Upon admission the patient was diagnosed as "schizrophrenic, paranoid type". Psychological testing revealed the depressive aspect of his feelings. On the ward the personnel found him depressed and diffident in his relations with the patients.

Methods

Two methods were used: the sociologic, including a standardized system for classifying social interaction (verbal exchange) material; and the physiologic, including three measures of autonomic system reactions.

Sociologic Method. The Bales system of interaction process analysis consists of twelve standardized categories or "dimensions" of human interaction. The observer was trained to infer reliably the meaning of a given statement with reference to 1) when and to whom it was spoken, and 2) category. The Bales system has been useful for microscopic study of social interaction in small face-to-face groups of children at play, classroom or discussion groups, committee meetings and work groups (3). This method's outstanding advantage is its reliability from observer to observer. Following is a list of the Bales categories (4).

1. SHOWS SOLIDARITY, raises others' status, gives help, reward.
2. SHOWS TENSION RELEASE, jokes, laughs, shows satisfaction.
3. AGREES, shows passive acceptance, understands, concurs, complies.
4. GIVES SUGGESTION, direction, implying autonomy for other.
5. GIVES OPINION, evaluation, analysis, expresses feeling, wish.
6. GIVES ORIENTATION, information, repeats, clarifies, confirms.
7. ASKS FOR ORIENTATION, information repetition, confirmation.
8. ASKS FOR OPINION, evaluation, analysis, expression of feeling.
9. ASKS FOR SUGGESTION, direction, possible ways of action.
10. DISAGREES, shows passive rejection, formality, withholds help.
11. SHOWS TENSION, asks for help, withdraws "Out of Field".
12. SHOWS ANTAGONISM, deflates others' status, defends or asserts self.

These categories, related each to the other by social interaction dimensions, logically admit all possible social actions: social action is observed as a series of events which are classified in one category after another (as from person to person) as the process of action moves from one dimension to another. Any given interchange between persons constitutes a scoreable event or "unit" in social action (5).

The Bales scoring technique has been modified for the present research as follows:

1. A machine was devised for recording scores by electrical impulses which were fed into the polygraph machine. This modification provided continuous synchronization of Bales scores and physiologic recordings.

2. A code was devised to represent the number of the categories.

3. The use of numerals for the "who-to-whom" signals was replaced by the use of long and short pen strokes above and below the polygraph tape line. The two-person system of individual psychotherapy always im-

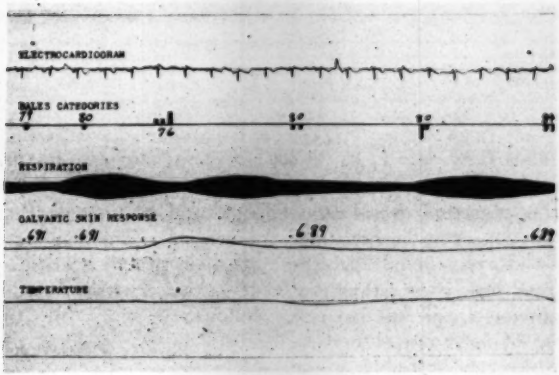

FIG. 1

plied the "to whom" direction of a verbal statement.

4. Non-verbal behavior was scored by lengthened signals. Figure 1, a section of the polygraph tape, illustrates the synchronization of variables.

Physiologic Method. On a polygraph, a modified Grass electroencephalograph, the following three physiologic variables are recorded simultaneously:

1. *Heart rate* was taken from the electrocardiograph measure.

2. *Galvanic skin response* was taken from recordings of an alternating, high frequency (800–1000 cps.) current, whose modulation indicates changes of skin conductance on the hand.

3. *Skin temperature* was measured from recordings taken from the face by a thermistor pickup whose alternating current potentials are modified by skin temperature changes recorded by a bridge.

PROCEDURE

The patient was brought by a research attendant to the experimental room and reclined on a narrow bed. Electrodes (surface leads) were attached to the patient's body for the recording of heart rate (from chest and wrist), skin resistance (from palm of hand and fingers) and skin temperature (from the face). First, the subject remained alone, in a quiet, restful position; meanwhile, physiologic measures were taken for 20 minutes (pre-treatment "resting" period). Then a psychiatrist entered the room and interviewed the patient for a period of 45 minutes. The interview material consisted of such topics as the patient's hospital experience, his suicidal attempt, his feelings about his wife, his job, sexual relations, and the patient's "agreeable" nature.

The sociophysiologist, with headphones behind a one-way-vision screen, observed and recorded the interaction events. After the interview the psychiatrist left the room and the patient rested quietly for 10 minutes (post-treatment "resting" period). Then the research attendant removed the electrodes from the patient and took him back to the ward.

TREATMENT OF THE DATA

Better than 90 percent reliability in Bales scoring by interjudge analysis was achieved by the sociophysiologist in Harvard Social Relations Laboratory prior to the scoring of data used in this study.

A period of time elapsed from the end of a scoreable statement to the appearance of the score on the moving polygraph tape: a reaction-time study of this lag in time showed that on an average the time required was 0.4 seconds.

The physiologic measures, as heart rate, skin resistance, and skin temperatures, when compared to interaction units revealed skewed and/or bimodal frequency curves: therefore, the data were treated with nonparametric methods. Primarily the Mann-Whitney U Technique was used (14).

TABLE 1.—AVERAGE OF PATIENT'S PULSE, GSR, TEMPERATURE AS TAKEN ON PATIENT'S INTERACTIONS

	Pre-Interview	*During Interview*			
	Rest	*Phase I*	*Phase II*	*Phase III*	*Total*
Pulse.....	78.6 beats per minute	87.3	83.0	83.6	84.3
GSR.....	.463 Ohms	6650	6890	6860	6760
Temp.....	35.508°C.	35.600	35.750	35.736	35.694

Studies in progress suggested consideration of the effect of respiration upon the heart rate, or sinus arrhythmia. It was found that the research subject showed little sinus arrhythmia; therefore, the assumption seems justified that significant differences of heart rate with social interaction levels, which may be found, would not be due to respiration arrhythmia.

To study the effect of phases of the interview (a measure used in Bales' studies), the interview was divided into three equal time periods, (6) and comparison was made of sociologic and physiologic data along the phase-dimension. "Emotion" as it appears in social situations may be operationally defined in Bales interaction analysis according to categories, as follows:

(1) Positive affect (categories 1-3)
(2) Neutral affect (categories 4-9)
(3) Negative affect (categories 10-12)

This operational definition does not imply the theoretical fallacy that some interchanges between people are without emotion: however,

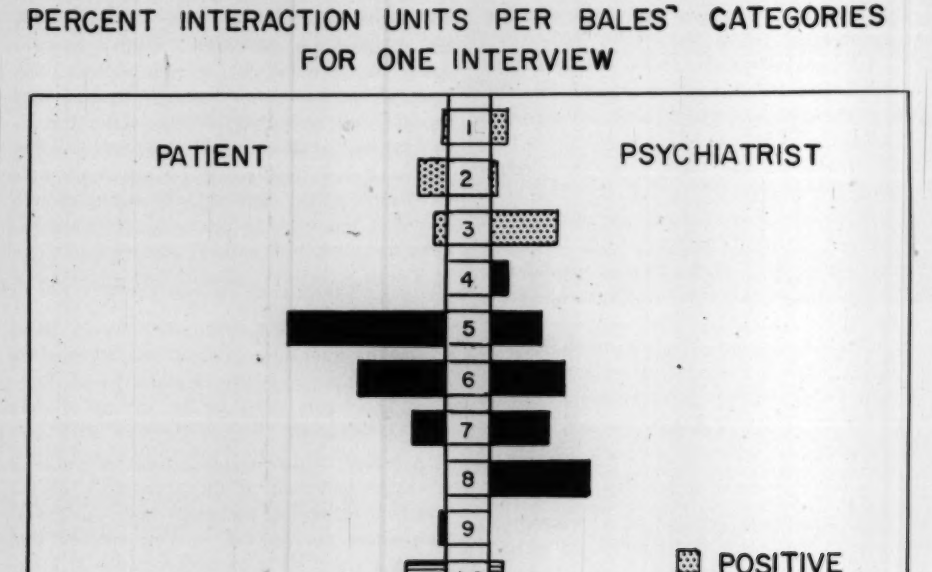

FIGURE 2. Percent interaction units per Bales categories for one interview.

TABLE 2.—AFFECTIVE LEVEL OF INTERACTION UNITS FOR PATIENT AND PSYCHIATRIST BY PHASES

	Phase I		*Phase II*		*Phase III*		*Total*	
	PT.	*MD.*	*PT.*	*MD.*	*PT.*	*MD.*	*PT.*	*MD.*
Pos.	8	23	6	15	16	21	30	59
Neut.	135	80	110	59	80	71	325	210
Neg.	13	1	21	2	34	13	68	16
Total	156	104	137	76	130	105	423	285

according to Bales scoring, where feeling or affect dominates content one of the "positive" or "negative" category scores is made.

RESULTS

Physiology at Rest and During Interview Stress. During the rest period the patient's skin temperature was higher, his heart rate was slower, and his sweating less than during the interview. From the start of the interview to its completion, the skin temperature rose and then dropped; the heart rate rose at the beginning of the interview (79 to 87), and dropped steadily toward the end of the interview; sweating was significantly higher (6500 ohms) than at rest (4633 ohms) and increased throughout the interview (6800 ohms at end of interview) (See table 1).

The interview proceeded within a physiologic process during which the heart rate became slower, sweating increased, and face temperature increased. This suggests that the interview produced an immediate increase in sympathetic nervous tension. With passage of time and the patient's apparent social adaption to the psychiatrist, there was sympathetic relaxation.

Interaction Profiles. The total responses of both the patient and the psychiatrist, with portions and percentages of "units" in each of the 12 categories, may be seen in figure 2. A comparison of the per cent "units" in each category for the two members of the group indicated the operation of two separate roles. The interaction dimension used most frequently by the psychiatrist is "questions" (the psychiatrist *asked* for opinion, evaluation, analysis, expression of feeling; the patient *gave* opinion, evaluation, analysis, etc.). Also the psychiatrist handled much of the patient's evaluation by agreement (category 3), suggestion (category 4) and "questions" (categories 7 and 8).

Productivity, another factor in interaction process analysis, was, in the main, a rôle function of the patient who worked at his "task" (gaining understanding of himself, insight). The patient was almost twice as "active" as the psychiatrist (total units for patient 492, for psychiatrist 275). However, the patient's interaction activity decreases as a function of time, or from Phase I to Phase III. (An attempt by the psychiatrist "to get the patient angry" was an experimental manipulation which may account for the psychiatrist's heightened productivity in Phase III). (See table 2.)

Positive and negative affect increased and neutral affect decreased, as a function of time in the interview. The increase, in Phase III, of the psychiatrist's negative affect probably is related to his attempt to make the patient angry. At the beginning of the interview sympathetic tension was elevated immediately and was accompanied by profuse "neutral" interaction: as the interview proceeded the patient expressed more feelings (cf. less neutral) and these were accompanied by reduced productivity and sympathetic relaxation.

TABLE 3—PATIENT'S PULSE AND SWEATING BY PHASES OF THE INTERVIEW AND SOCIAL AFFECTIVE LEVELS

		Phase		
		I	*II*	*III*
Pulse	Positive	90.8	85.7	86.5
	Neutral	86.2	82.4	82.4
	Negative	85.1	81.1	81.8
GSR	Positive	6440	6910	6780
	Neutral	6660	6880	7000
	Negative	6760	6940	7030

Physiology and Affective Level of Interaction. Concomitant changes of the patient's physiologic variables with interaction affects (positive, negative, neutral) are shown in table 3. Note that the heart rate with positive affect was always faster and with negative is slower; that sweating with positive was less

and with negative was greater. Sweating and heart rate with neutral affect fell between the extreme points represented with both positive and negative affect. Note further, that although average heart rate and sweating levels were greatest at the beginning of the interview, a similar ratio prevailed during physiological expression of positive, neutral, and negative emotion.

Physiology and Interaction "Reaction" and "Proaction". A "reactive" unit is defined as a statement which is in direct response to a statement by the "other" person; a "proactive" unit is defined as a statement made by a person "in response", so to speak, to one's own reactive statement and includes all units made by the same person until another person reacts to him. No significant differences were found in either heart rate or in sweating when reactive and proactive units were compared.

Summary

This report, considering one case, investigates the relationship between autonomic physiology (heart rate, skin resistance, and face temperature taken simultaneously on a polygraph) during psychiatric therapy. An increase in sympathetic tension at the beginning of the interview was accompanied by high "neutral" productivity; this was followed by sympathetic relaxation with the progression of the interview which was accompanied by greater "social-emotional" productivity. Positive social affect was accompanied by increased sympathetic activity (i. e., lower pulse, greater sweating) at any time throughout the interview.

This study introduces an extension of psychophysiological investigation into social territory, a new interdisciplinary field for research which may be called "sociophysiology." The correlation of sociophysiologic variables may lead eventually to a better understanding of psychiatric problems of diagnosis and prognosis in psychotherapy.

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EFFECTS OF ELECTROCONVULSIVE THERAPY ON PERSONALITY AND INTELLECTUAL FUNCTIONING OF THE SCHIZOPHRENIC CHILD [1]

SAUL GUREVITZ AND WILLIAM H. HELME

Problem and Experimental Design

Earlier Studies. Studies of the effects of electroconvulsive therapy on the psychological functioning of schizophrenics have yielded variable findings. Summarizing the results of studies up to 1946, Kalinowsky and Hoch (12) make these points: (a) most studies were limited to the immediate effects of electric shock, without longer term followup, (b) no significant effects on memory function or learning ability were reported except in a few isolated cases, and (c) the treatment appears to "have a curative effect on the secondary or compensatory personality changes but not upon the primary repression of the schizophrenic process" (12, p. 136). Reporting on 98 schizophrenic children treated by electric shock, Bender (3) points out that of 54 cases tested before, immediately following, and at intervals after shock, the I.Q. range and mean did not change significantly. The mean score after shock was 84.5 as compared to 83 before treatment. From these and other findings she drew five general conclusions: (a) the essential schizophrenic process does not appear to be modified, (b) the child improves in his coping with anxiety and secondary symptom formations, (c) there is no interference in intellectual functioning and development, (d) prognosis seems better with electric shock as part of the whole treatment program, and (e) children tolerate electric shock better than adults, and the post-shock modification in behavior and clinical course of the disorder appears positive. Interpreting projective test data on some of the same cases, des Lauriers and Halpern (8) conclude that "shock treatment has broken down all the superadded structures, the neurotic and anxious features, and there now appears in strong relief a clearly defined picture of schizophrenia" (8, pp. 65-66). Intellectually they find a greater capacity for concentration, a slight increase in I. Q. and no change in reasoning and judgment. Personality changes found involve a flattening of affect characterized by a "lack of impetus and true affective meaning" with a simultaneous "free flow of reactions, impulses and drives." Socially there appears to be an improved capacity for dealing with environmental matters, though in a flat, shallow way. In general, the approach is more concretistic and autistic, with a reduction in fantasy life. The authors point out that: "Even when clinical observations shows (the child) to be restless, aggressive, and destructive, his test productions show a diminution in psychic activity" (8, p. 66).

A more negative view is expressed by Clardy (7). He states: "In the 10 cases that received electric shock therapy practically all the children became worse, after sometimes having a history of initial improvement" (7, p. 88). He goes on to mention the great fear of treatment evinced by the children, which contrasts markedly with Bender's observations (3). He recommends use of electric shock only as a last resort, pointing out: "There is little knowledge of the damage shock therapy will do to the brain cells of a developing child and of the effect it will have on the developing personality or brain function in later years" (p. 88).

The present investigation follows some preliminary findings in a study conducted by Theodore B. Cohn at Bellevue Hospital in 1947. Cohn found a definite drop in intellectual functioning immediately after completion of a series of 20 shock treatments, but no later follow-up testing was carried out on his cases. The present study was begun in part to resolve this question of the permanence of the

[1] This investigation has been supported by a research grant from the National Institute of Mental Health, of the National Institutes of Health, Public Health Service. The project was directed by Dr. Lauretta Bender.

[2] Electric shock was administered with Rahm Instrument, classical technique, 110-130 volts, 0.1-0.2 secs. duration, 20 treatments.

effects. Concurrently, Bender and Keeler (6) studied the effects of shock treatment on body image as expressed in the Goodenough Draw-A-Person Test. They found preservative and primitive features, an increase in anxiety as manifested by shading, distortions of figures other than primitivization, bizarre elements, and undue emphasis on boundaries, immediately after shock. At the same time, more constructive discrete elements appeared in the drawings which had not been present before shock. It is important to note that Bender and Keeler tested the children much sooner after the shocks than had the other investigators—sometimes within the hour—and during the shock series. When they retested these same children 36 hours or more after termination of the series, the organic signs had disappeared in the majority of cases. The new elements, however, remained in several cases long after the distortions had disappeared. The same phenomena of regression and distortion appeared even more pronounced in the Bender Gestalt test forms, and likewise disappeared in most cases soon after the end of the shock series.

Design of Present Study. In the present study, two steps are undertaken to further the exploration of the effects of electric shock treatment on schizophrenic children. The first is to provide for testing not only before and soon after (24 to 48 hours) treatment but also at a sufficiently long interval after cessation of shock treatment to reveal what effects are lasting. The second is to select and interpret the tests within the framework of a systematic theory of childhood schizophrenia, making explicit the relations between theory, predicted findings, and empirical findings. This investigation is a preliminary exploration of the possibilities of such an approach. The systematic theory used is that of Lauretta Bender (5).

Childhood schizophrenia is described by Lauretta Bender as characterized by pathology in the pattern of every functioning field: vasovegetative, motor, intellectual, emotional, and social (5). Such a concept requires that a study focussed on one aspect, e.g., I.Q., must not be confined to measures within that area alone. Rather, the relation of changes within the area to accompanying changes in the total functioning pattern—biological, psychological and social—must be studied in order to understand the meaning of changes within the area per se. This is the ideal goal. In practice some selection and abstraction of aspects from the ideal totality must be made; but it is important to make such abstractions explicit.

The present study focusses on changes of intellectual efficiency in schizophrenic children with electric shock therapy. We begin with a comparison of I.Q.'s before and after the shock series, as a measure of average level of intellectual efficiency. Next we seek to differentiate within the area of intellectual efficiency by a study of changes in performance on different kinds of items in a test of abstract reasoning. Finally, we try to relate these changes to changes in the total functioning pattern of the individual as revealed by standard drawing and gestalt tests.

For this first exploration, sixteen cases with an independent diagnosis of childhood schizophrenia were used. All had been admitted to the Children's Psychiatric Service at Bellevue Hospital, New York City. For a clinical description of this type of group the reader is referred to the earlier study by Gurevitz and Klapper (11). The age range extended from 6–5 to 13–3 with a mean of 9–11. Fifteen were males, with one female aged 11–1.

Three measures of intellectual functioning were used: The Revised Stanford-Binet (Form L or M), the Non-Language Multi-Mental Test Form A (Ternan, McCall and Lorge), and the Goodenough Draw-A-Man Test. All three yielded I.Q.'s. The Binet was chosen as a standard measure of intellectual efficiency, the Non-Language Test both because it was less influenced by verbal facility and afforded a measure of different kinds of abstract thinking, and the Goodenough both for its adaptability to measurement of disturbed children and its value as an instrument for personality diagnosis.

Three measures of total personality functioning were used: The Goodenough test, the Bender Visual-Motor Gestalt Test and the Trees-Fence-and Road Drawing Test. The last-named was used as a limited free drawing. The subject is requested to make a drawing containing three trees, a fence, and a road. The drawings can be interpreted projectively, but in the present study only structural characteristics were

TABLE 1

TIME INTERVALS BETWEEN INITIAL AND FINAL TESTS

Months	*Cases*
4– 7	3
8–11	3
12–15	7
16–19	0
20–23	0
24–27	3

considered. Both the Goodenough and Bender-gestalt tests were similarly treated.

Each subject was tested three times: just before beginning electric shock treatments (2), immediately after completing the series of twenty shocks, and 5 to 27 months afterward. The Stanford-Binet was not given at the last testing, however. All subjects took the Non-Language test three times; a few missed the Goodenough or the Bender-gestalt test on one occasion. All tests were individually administered by the same psychologist. The distribution of time-intervals between initial and final testing is shown in table 1.

VARIABLES STUDIED AND RESULTS OBTAINED

Changes in Intellectual Performance. Results of analysis of I.Q. changes are shown in table 2. All tests show a drop immediately after shock (24 to 48 hours after), statistically significant for the Binet and Non-Language tests, nearly significant for the Goodenough. Both the Non-Language and Goodenough tests show recovery at final testing, significantly higher than immediately after shock. Both show a rise from initial to final testing, but neither rise is significant for this size sample. Analysis of individual cases shows that four cases show drops of 7 to 26 points on the Goodenough, one remains the same, and nine show rises of 2 to 43 points from initial to final testing. On the Non-Language test, five show drops of 6 to 26 points, two show drops of one point, and nine show rises of 2 to 43 points. It is interesting to note that two cases drop on both tests; but on the other hand, one who drops 15 points on the Goodenough maintains his level on the Non-Language test, while one who drops 7 points on the Goodenough rises 43 points on the Non-Language.

In detailed analysis of the Non-Language

TABLE 2

MEAN I.Q.'S AT FIRST, SECOND, AND FINAL TESTS

	Mean Scores		
Time of Testing	*Good-enough*	*Binet*	*Non-Language*
Before Chock	81.36	92.33	83.38
After Shock	76.43	82.00	65.62
Follow-up	87.00	—	87.31
	Significance of Differences (t)		
Testings Compared	*Good-enough*	*Binet*	*Non-Language*
Second–first	0.91	3.77†	4.90*
Third–first	0.85	—	0.78
Third–second	2.25‡	—	3.55†

* Significant at 0.001 level.
† Significant at 0.01 level.
‡ Significant at 0.05 level.

test, the items were categorized in two ways: (a) according to nature of content and (b) according to nature of logical relationships involved. The test presents panels of five pictures or figures; the subject is required to pick the one that does not belong with the other four. The authors distinguish five different kinds of relationship (13). In the present study these distinctions were extended to eight, as follows:

1. Possessing common qualities: two pairs.
2. Possessing common qualities: four of a kind.
3. Identical structures in opposite (180°) orientation: two pairs.
4. Common use: pairs or four of a kind.
5. Parts of same whole: four of a kind.
6. Parts of a whole, with the whole the excluded form: four of a kind.
7. Identical: four of a kind.
8. Sequences: four in correct succession.

The analysis by content yielded three categories: (a) living objects, (b) inanimate objects, and (c) geometrical abstractions. This breakdown will be discussed first.

Table 3 gives mean scores (number of items correct) for each content category at each testing. Per cent of items correct is also shown. All categories show a drop immediately after the shock series, and a recovery at time of follow-up higher than the point of original testing. When allowance is made for the expected

TABLE 3.—MEAN SCORES AND PER CENT CORRECT ON EACH CONTENT-CATEGORY: NON-LANGUAGE MUTI-MENTAL TEST

Content Category	*M1*	*M2*	*M3*	*P1*	*P2*	*P3*	*Avg. P*
Living Objects	9.06	6.69	10.69	51	37	59	49
Geom. abstractions	7.06	5.75	7.44	45	35	51	44
Inanimate objects	7.44	6.38	9.12	54	44	57	52

TABLE 4.—MEAN SCORES AND PER CENT CORRECT ON EACH KIND OF LOGICAL RELATION: NON-LANGUAGE MULTI-MENTAL TEST

Logical Relation	*M1*	*M2*	*M3*	*P1*	*P2*	*P3*	*Avg. P*
Pairs by common quality	7.00	4.75	8.06	50	34	58	47
Groups by common quality	6.69	5.31	6.94	61	51	63	58
Pairs by oppos. orient.	2.44	2.12	3.25	30	27	41	32
Pairs of groups by use	4.31	3.81	4.69	54	48	59	54
Parts of same whole	1.31	0.88	1.50	66	44	67	61
Parts with whole excluded	2.00	1.88	2.50	33	31	42	35
Identities	3.00	2.25	3.19	58	45	66	56
Sequences	2.00	1.75	2.44	33	29	41	34

increase with age between second and third testings, however, the only significant change from second to third testing is found in the living objects category, which is the one showing the most significant drop from first to second. Moreover, all categories show some recovery even when allowance for age is made, and no categories show significant improvement from first to third testings when age correction is applied.

Table 4 shows mean scores at each testing for each item-type according to logical relation involved, and the per cent correct. Only the items related by common qualities, both pairs and fours, show a significant decline from first to second testing and a significant recovery from second to third. Correction for age eliminates the significant recovery on groups of four by common quality. Again the general finding is that differences from first to third testing, corrected for age, tend to be positive but not of significant extent on this size sample.

Although few significant differences appeared in mean scores on single item-types, it was considered possible that differences in the organization of abilities to solve given types might have changed from one testing to the next. The small number of cases precluded formal factor analysis. But the data needed to compute statistical significance of mean differences also facilitated the calculation of intercorrelations among the eight item-types. Results are shown in table 5. These results were analyzed by representation in cluster diagrams shown in figures 1, 2, and 3. The more positive the correlation, the closer the boxes representing the given item-type were placed fig. 3. While there is undoubtedly some distortion involved in representing all the relations in the matrix on a plane surface, the schemata are generally correct. The organization before shock treatment, seems to be characterized by triads connected in a more or less chain-like fashion, attached to a central grouping composed of pairs and groups by common quality, groups by use, and parts of same whole. Immediately after the shock series, the central grouping is composed of pairs and groups by common quality, groups by use, and identities. A number of negative coefficients of moderate size appear. Finally, in the followup testing, a more integrated picture is found. The major focal grouping still contains pairs and groups by common quality, and groups by use as before, but now the fourth member is sequences. Although these groupings are based on correlation differences which are individually nonsignificant, it can be suggested that the changes observed are worth investigating on a larger sample.

Changes in Personality Measures. Next we turn to analysis of the structural features of the Bender-gestalt and Goodenough tests. All 16 cases took the former three times, but only

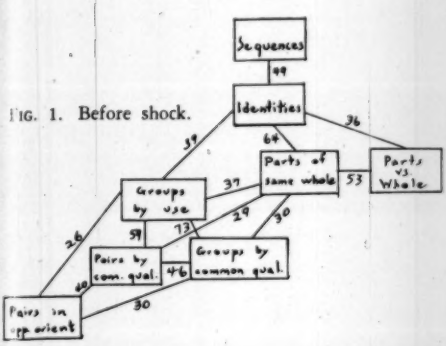

FIG. 1. Before shock.

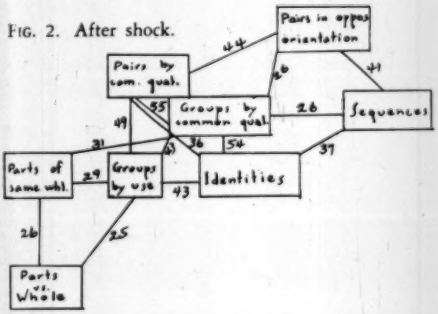

FIG. 2. After shock.

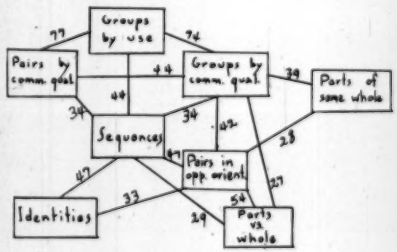

FIG. 3. Follow up.

14 were given the latter. The gestalt test was rated for the presence of these pathognomic signs.

1. *Vertical shift:* Tendency to rotate figures from horizontal or diagonal orientation to the vertical.
2. *Confusion in complex organization:* Tendency to fragment or to differentiate complex figures (#'s, 3, 5, 7 and 8 in particular).
3. *Closure:* Tendency to close gaps in figures or to exaggerate them so as to fragment simple figures or subwholes of complex figures.
4. *Space-figure relations:* Diminishing or magnifying the single figure in relation to the total space for all.
5. *Plasticity:* Quality of forms in which the boundaries appear fluid, changeable, or "plastic." Limits appear indefinite and inconstant: an ameba-like flow seems to be implied in the character of the drawing.

The Goodenough tests were evaluated for these signs:

1. *Poor integration:* Quality of organization of the human figure in which poor connections of limbs, head and trunk, or poor symmetry of placement of parts, etc., gives the impression that the figure is likely to fall apart.
2. *Poor posture-balance:* Tendency toward asymmetry or instability of the figure in relation to its center of gravity.
3. *Space-figure relation* (See 4 above).
4. *Movement:* Applied only to figures which are not drawn in the act of movement. While static, the figures nevertheless appear to possess a kind of potential movement, implied by the posture and tension of the body. Alternatively, the implied movement may be expressed primarily in the flowing quality of the lines per se. The core of the concept is that the impression given by the figure is one of loss or absence of stabilizing controls. Either the muscular impulses and drives are moving the figure without being mediated by conscious intent, or the stabilizing forces outside, e.g. gravity, appear inoperative (plane of unreality).
5. *Plasticity* (see 5 above). In the human figure, an impression of "doughiness" is given.

Table 6 presents the incidence of each pathognomonic sign on the two tests at each testing. The results indicate that there is a clear trend toward lower incidence from first to third tesing and, unlike the results on intellectual functioning, no clear trend toward higher incidence from first to second. Only one sign—space-figure relations on the Goodenough test—shows a significantly lower incidence at the third testing. When all signs on

TABLE 5.—INTERCORRELATIONS OF ITEM-TYPES BASED ON NATURE OF LOGICAL RELATIONS: NON-LANGUAGE MULTI-MENTAL TEST

	Before Shock						
Item-type	2	3	4	5	6	7	8
1. Pairs, common quality	46	40	59	29	08	05	16
2. Groups, common quality		30	73	30	02	15	—05
3. Pairs, opposite orient.			26	—19	—03	—16	22
4. Groups, use				37	06	39	07
5. Parts of same whole					53	64	16
6. Parts, whole excluded						36	00
7. Identities							49
	After Shock						
Item-Type	2	3	4	5	6	7	8
1. Pairs, common quality	55	44	49	—08	10	36	14
2. Groups, common quality		26	43	31	—07	54	26
3. Pairs, opposite orient			—06	—34	—34	05	41
4. Groups, use				29	25	43	—18
5. Parts of same whole					26	02	—32
6. Parts, whole excluded						17	—32
7. Identities							37
	Follow-up						
Item-Type	2	3	4	5	6	7	8
1. Pairs, common quality	44	42	77	20	05	00	34
2. Groups, common quality		44	74	39	27	15	34
3. Pairs, opposite orient.			34	28	54	33	47
4. Groups, use				23	18	26	44
5. Parts of same whole					—04	—07	—29
6. Parts, whole excluded						—15	29
7. Identities							47

a given test are added together, however, the mean number of pathognomonic signs declines sharply from second to third testing. The decline is approximately 40 per cent of the pre-shock treatment total. It is significant at the 0.02 level.

Analysis of the structural aspects of the Tree-Road-Fence test may be divided into three categories: (1) characteristics of the total organization, (2) characteristics of lines, (3) characteristics of content organization (trees, road, fence). Aspects of the total studied were:

1. *Vertical extent:* Proportion of vertical length of paper included between upper and lower limits of drawing.
2. *Horizontal extent:* Same proportion, left to right.
3. *Density:* Rating on a three-point scale: (1) dispersed, (2) close, (3) dense.
4. *Vertical center of gravity:* On six-point scale in terms of vertical sixths of paper from +2.5 at the top to —2.5 at the bottom.
5. *Horizontal center of gravity:* Same, from +2.5 at the right to —2.5 at the left.
6. *Differentiation of gestalt:* On scale: (1) vague, (2) well-defined, (3) details stressed.

Aspects of lines studied were as follows:

1. *Plasticity (as defined before):* On scale: (1) vague, plastic, (2) flexible, (3) rigid.
2. *Movement (as defined before):* On scale: (1) strong movement, (2) movement tendency, (3) stable.
3. *Connection:* On scale: (1) disjointed, (2) connected, (3) closed, carefully-bounded figures.
4. *Steadiness:* On scale: (1) wavering, (2) straight, (3) solid, firm.
5. *Angularity:* On scale: (1) curved, (2)

TABLE 6.—INCIDENCE OF PATHOGNOMONIC SIGNS ON GESTALT AND DRAW-A-PERSON TESTS

Bender-gestalt test
N=16

Pathognomonic Sign	*f1*	*f2*	*f3*
Vertical shift	11	9	8
Distorted org'n	11	10	9
Closure	12	9	5
Poor use of space	10	11	5
Plasticity	11	13	5

Draw-A-Person test
N=14

Pathognomonic Sign	*f1*	*f2*	*f3*
Poor integration	9	9	4
Poor balance	8	10	8
Poor use of space *	11	10	3
Pathol. movement	7	4	6
Plasticity	7	6	4

* Difference between tests 1 and 3 significant at 0.02 level; between 2 and 3, at 0.05 level.

Mean number of pathognomonic signs

Test	*M1*	*M2*	*M3*
Bender-gestalt†	3.44	3.31	1.94
Draw-A-Person†	3.00	2.64	1.79

† On both tests, differences between tests 1 and 3 are significant at 0.02 level.

mixture of curves and angles, (3) angular.

6. *Shading:* On scale: (1) thin, (2) heavy, (3) chiaroscuro effect.
7. *Pressure:* As denoted by the impression made on the paper, discernible either tactually or through the transparency of the paper from the other side. Scale: (1) undiscernible pressure, (2) light, (3) heavy.

Content aspects studied were as follows:

1. *Trees:*
   a. Vertical center of gravity, each tree.
   b. Horizontal center of gravity, each tree.
   c. Crown to total height proportion—each tree rated on three-point scale and average taken. Total height is sum of crown and trunk ratings.
2. *Road:*
   a. Vertical center of gravity.
   b. Slope: Scale according to central angle (1) 0°, (2) 45°, (3) 90°. Means obtained in terms of 0, $\pi 4$, $\pi 2$.
   c. Vectorial tendency: (1) not directed, (2) ambiguous in direction, (3) direction clearly indicated. Estimate of this tendency is made in part from perspective and in part from the way upward and downward slopes, different widths and curvature are used. In general, the non-directed road shows a flat, mechanical regularity of slope, width, etc., while the directed one gains a kind of organic quality from the use of differences in these properties.
   d. Size—scale: (1) small, (2) average, (3) large.
3. *Fence:*
   a. Vertical center of gravity.
   b. Size (as on road.
4. *Content relationships:*
   a. Size comparison of trees, road and fence.

Where quantitative scores could be used singly, critical ratios of differences between means at first, second and third testings were obtained. For comparisons, such as in content relationships of size, the chi-square satistic was applied. Results are shown in table 7.

Few significant differences appear on single scores. The only concentration of such differences in greater than chance incidence is found in the aspects of lines studied: steadiness, shading and, in particular, pressure. All of these scores show increases, either from first to second testing, or from second to third.

When the direction of change of single scores is taken into account as a whole, however, significant general trends appear. Proportion of paper used (extent) increases. Other changes in total and content aspects may be meaningful but no surface consistency is apparent. On line aspects, on the other hand, all the single items change in the same direction, insofar as directions can be equated on them. On plasticity, the change is toward greater control. On movement, the change is likewise toward less pathognomonic movement, i.e., greater control. On connection, the trend from first to third testing is slight, but is toward greater connectedness. On steadiness, all

TABLE 7.—MEAN SCORES ON STRUCTURAL ASPECTS OF TREES-FENCE-ROAD TEST

Aspect	*M1*	*M2*	*M3*	*Sig Diff*	*Level*
Total picture:					
Vertical extent	0.750	0.743	0.855		
Horizontal extent	0.948	0.898	0.948		
Density	1.83	1.92	1.50	1–3	0.05
Vertical center	—0.583	—0.667	—0.250		
Horizontal center	—0.417	—0.500	—0.500		
Differentiation gest.	1.58	1.58	1.83		
Lines:					
Plasticity	2.08	2.08	2.42		
Movement	2.33	2.25	2.08		
Connection	2.00	1.83	2.08		
Steadiness (road)	1.50	1.75	2.00		
Steadiness (fence)	1.58	2.00	1.92	1–2	0.05
Steadiness (total)	3.08	3.75	3.92	1–2	0.05
Angularity (trees)	1.42	1.42	1.75		
Angularity (fence)	2.42	2.67	2.33		
Angularity (total)	3.83	4.08	4.08		
Shading (trees)	1.92	1.75	2.08		
Shading (road)	1.83	1.83	2.25	1–3, 2–3	0.05
Shading (fence)	1.67	1.92	2.08		
Shading (total)	5.42	5.50	6.42		
Pressure (trees)	1.33	1.58	1.17		
Pressure (road)	1.25	1.83	1.25	1–2, 2–3	0.01
					0.05
Pressure (fence)	1.08	2.08	1.42	1–2	0.01
Pressure (total)	3.67	5.50	3.83	1–2	0.001
				2–3	0.01
Trees:					
Vertical center (L)	0.500	0.417	0.917		
Vertical center (M)	0.833	0.333	1.083		
Vertical center (R)	0.833	0.250	1.167		
Horizontal center (L)	—1.75	—1.58	—1.58		
Horizontal center (M)	—0.167	—0.417	—0.417		
Horizontal center (R)	1.08	0.833	1.33		
Crown: height	0.442	0.469	0.467		
Average size	3.83	3.08	4.25	2–3	0.05
Road:					
Vertical center	—2.25	—1.50	—1.75		
Slope (π)	0.062	0.048	0.146		
Vector tendency	1.67	1.58	2.08		
Size	1.92	1.83	1.58	1–3	0.05
Fence:					
Vertical center	—1.33	—1.58	—1.42		
Size	1.92	1.58	1.83		

Other differences tested by chi-square statistic based on frequencies at each testing were: pressure (road vs. fence), steadiness, angularity and shading (trees vs. road vs. fence), size (among trees), and size (trees vs. road vs. fence). Only the pressure difference was significant, with greater pressure on the fence than on the road being shown by two out of 12 cases before shock, but by eight out of 12 at second and third testings. Chi-square was significant at 0.05 level.

lines become straighter and firmer. On angularity, the trend in both tree and fence is toward a mixture of curves and angles, with the more pronounced trend shown in the tendency toward angularity of the tree. On shading, the direction is likewise toward decrease of the pathological sign (thin lines), which constitutes increase of shading score. This will be discussed subsequently; it suffices at this point to state that such an increase of shading usually connotes an increase of affective and sensual response and expression. On pressure, the change from first to third testing is very slight, but is again in the direction of increase, con-

noting increased flow of energy toward the outside world. Such interpretations would appropriately be reserved for a later section. They are given here as hypotheses derived from theoretical views widely supported on other tests, to show the way in which data on single aspects must be combined for meaningful results.

Discussion of Results

1. Predictions from Theory. While it is beyond the scope of the present paper to present a finished theory of the psychological effects of electric shock on schizophrenic children, it is nevertheless true that any interpretation of data proceeds from the general theoretical framework of the interpreter. Consequently, it is important to make certain theoretical propositions explicit.

First, all persons are subject to forces and pressures within and without, e.g., biological drives, social motives and requirements, physical forces and constraints. The normal person copes with these by isolating and organizing them in a number of compartments. One compartment, called reality, includes only those aspects of one's experience of these forces which can be tested by reference to sensory data and lawful, logical thought-processes which are held *in common* with other persons. Thus "common-sense reality" would be an appropriate term for this compartment. In the schizophrenic, we speak of inadequate reality-testing in that he does not accord prime validity to the common-sense experiences. Moreover, not only is the common-sense reality not maintained at the summit of his hierarchy, but the boundaries of this and other compartments are more fluid and permeable. For example, the schizophrenic child confuses symbol and concrete object, boundaries of the self and other objects, including other persons, as many examples attest (4).

The pressures and forces experienced by the schizophrenic may therefore arise either within the common-sense reality compartment, within other compartments, or between compartments effectively isolated by the normal person. It is worth noting that for the normal person these other compartments are experienced as planes of reality and irreality, e.g., planning, imagining, recalling, abstracting. For the schizophrenic all these may at times coexist on the same plane. Isolation of regions on a plane, and of planes as relatively autonomous systems, is incomplete and unstable.

The schizophrenic struggles toward more effective isolation and organization. His symptoms, whether they be social-emotional (e.g., withdrawal) or characteristic thought-processes (e.g., phobias, obsessions, confusion of symbols and concrete objects), are attempts to achieve better compartmentation. The concept here includes the idea that such symptoms are an attempt to form defensive structures to contain the threats of powerful global forces.

One general impression gained from the data of this study as a whole is that electric shock therapy breaks the boundaries of all these compartments to some extent, thus permitting changes in the organization of the whole and within particular compartments. In evaluating the data we are using the common-sense reality compartment as a frame of reference; therefore our concern is with the effects of shock on its boundary with other compartments and its internal structure (boundaries of regions within). What consequences would follow theoretically from the above assumption as to general effects of electric shock?

First, we can observe that *awareness* of forces and pressures is less in the normal than in the schizophrenic because of the greater strength of boundaries around common-sense reality in the former, and its secure position at the top of his hierarchy. Shock, however, weakens boundaries in the schizophrenic but at the same time reduces his awareness of the disturbing forces. How can this be explained? The authors believe that awareness in the human being is dependent upon compartmentation. The relation of this concept to such disparate views of the ego as those of Koffka and Freud is obvious. The awareness of the schizophrenic before shock is disturbing to him because of structurally faulty compartmentation, not a lack of it. The effect of shock is therefore to reduce all functioning which depends on compartmentation, including awareness, to a lower level of intensity.

Second, it follows that the immediate effect of shock should be to impair intellectual functioning that requires higher differentiation and

organization. Abstract reasoning should be most affected; simple perceptual motor organization least.

Third, it follows that reduced awareness leads to a reduction in anxiety. Obviously awareness per se does not lead to anxiety. Awareness plus inability to cope with the forces of which one is aware creates anxiety.

Fourth, it follows that the forces from within will flow more freely because of the constraints broken up by shock. Thus, expressions of feelings, including anxiety, will be more immediate and less inhibited. The result may be an apparent increase in anxious behavior which nevertheless does not reflect a greater anxiety.

2. Comparison of Results of First and Second Testings. Let us now examine the statistical findings of the first and second testings in the light of the foregoing hypotheses. We find that general intellectual functioning drops sharply immediately after shock, as would be predicted by the concept of a weakening or breaking of compartment boundaries. The greatest effect is to be expected on those measures where higher organization and articulation are required, as in the Non-Language test, and, to a slightly lesser extent, in the Binet. No consistent effect is to be expected on simpler perceptual measures, such as the Bender-gestalt test. When the perceptual-motor test involves expression of the boundaries of self or body-image, however, in contrast to boundaries of objects outside the self, some impairment is to be expected. The results follow this prediction:

Test	*Significance of decline (t)*
Non-Language	−4.90
Binet	3.77
Goodenough I.Q.	0.91
Bender-gestalt structure[3]	No decline
Goodenough structure[3]	No decline

Furthermore, the detailed analysis of the Non-Language test supports the hypothesis in that the organization of relationships among different types of items (the organization of specific abilities operationally defined) is much more global and diffiuse immediately after shock than before.

Next we turn to the Trees-Fence-Road test.

[3] No I.Q.; ratings of structural aspects only.

As mentioned earlier, the statistical findings showed an increase in steadiness and pressure immediately after shock without an accompanying increase in shading or in control of tendencies to plasticity, movement and disconnectedness. The Goodenough and Bender test structural aspects likewise show no consistent direction of change in control of the same tendencies, toward either better or worse organization. These results may be interpreted as follows:

1. Increased steadiness and pressure of line is usually indicative of a less inhibited, stronger flow of libido. Implied in the same concept is the idea of a more concentrated and directed flow of energy. Thus the results indicate a stronger and more directed flow of drives immediately following electric shock.

2. Onthe other hand, the fact that increased shading does not accompany increased flow of energy suggests that, immediately after shock, there is no change toward increased awareness and responsiveness of feelings to sensual stimulation. On the scale used here, when the shading score approaches 3 (chiaroscuro), diffuse anxiety may be suggested. Thus it appears that the increase in drive-flow is not accompanied by an increase in sensual responsiveness or anxiety.

3. Similarly, immediately after shock, on the structural aspects of the gestalt and person-drawing tests, and on related aspects of the Tree-Road-Fence test (plasticity, movement, connection, angularity) there is no indication of consistent changes from pre-shock testing. This finding indicates that we cannot attribute the absence of anxiety to the operation of more effective controls or defenses.

How can these results be harmonized? Let us refer back to the four theoretical hypotheses set up at the beginning of this section. The suggestion made was that shock reduces all functioning which depends on compartmentation—including awareness (first point), intellectual effectiveness (second point), and anxiety (third point). Thus both the results on I.Q. measures in general and on the analysis of gestalt and other drawings are in agreement. But the hypotheses have still further application to our results. Differences in decline of the five measures listed earlier can be better explained in terms of a two-factor theory than

on the basis of "higher organization required" alone.

The factors are: (1) level of intellectual-cognitive articulation and organization required as discussed earlier, and (2) extent of energy-flow and directedness to objects (vectorial tendency) required for effective functioning on the measure. Obviously both factors are complex. The first involves both differentiation and integration on the cognitive level. The second involves three aspects: (a) emotional flow, (b) drive energy and (c) the directedness best expressed as vectorial tendency. (Three concise equivalents are found in the German terms (a) Affekt, (b) Trieb and (c) Akt.) The two factors are to be found in different relative amounts in each test. Taking the measures used in this study, the following arrangement may be made, in order of decreasing importance of the first factor and increasing importance of the second:

1. *Non-Language test:* Requires high level of cognitive articulation and organization but constraints of process imposed by the materials (multiple choice, highly structured problems) reduce the contribution of drives and direction as described above.
2. *Binet Test:* Requires moderate to high level of cognitive effectiveness. Constraints of process are less than in the Non-Language test (subject presents and organizes answer in own terms) and contents involve social situations to a limited extent. Thus contribution of drives, affect and direction is small, but greater than in 1.
3. *Goodenough test, I.Q. rating:* Requires moderate cognitive effectiveness, since score depends on number of differentiated aspects presented and their integration in the whole figure. Constraints of process are less and contribution of drives, affect and direction more, since this is an *expressive* medium.
4. *Bender-gestalt structural aspects:* Requires only relatively simple level of cognitive differentiation and organization. Structure of problems is quite confining (copying only) but subject is permitted considerable expressiveness in the placing and rendition of the figures.
5. *Goodenough structural aspects:* In this scoring the expressive characteristic of the drawings are emphasized, the details of articulation and accuracy less emphasized than in intelligence scoring of the same test.
6. *Tree-Fence-Road test:* In this test constraints of process are least and expressiveness is at a maximum.

It is clear that those measures decline most which require more of the first factor than of the second. This is true even though the evidence suggests that *the affective component of the second factor is not increased immediately after shock.*

3. Findings from Third Testing. Now let us turn to the findings on the third testing. The hypothesis is that some kind of reorganization and reconstruction of compartment boundaries takes place with the passage of time. It is important to note that the breaking of boundaries is not complete and all-pervasive even immediately after shock. One would expect, furthermore, that the forces most active in reorganization would be the directedness of the drives (aspect c of the second factor) and the global environmental influences to which the subject is more accessible and responsive as a result of shock. If these global influences are systematically administered, as in psychotherapy, the possibilities for a better organization of the individual would seem to be enhanced.

On the Non-Language test, primarily a measure of abstract reasoning, significant recovery takes place between second and third testing. On the Goodenough I.Q. measure an even greater recovery takes place, although the difference in recovery between the two tests is not significant for this sample. Likewise, the difference in I.Q. from original to final testing is not significant although the trend is upward. The evidence shown in figures 1, 2, and 3 also suggests that an organization is formed on the abstract reasoning test that is better than the original organization.

Study of the structural aspects of the Bender and Goodenough tests reveals, however, that *significantly fewer* pathological signs appear at the third testing than at the first. In other words, the control is much more effective than

it was before electric shock. On the Tree-Fence-Road test, however, shading is significantly increased from first to third testing, but steadiness has maintained its gain and pressure has dropped back to its initial level. Together these findings indicate that, with the restored, possibly improved organization, awareness and responsiveness of feelings has increased. There is an attendant increase in anxiety. As a result of the combination of clearer cognitive awareness and the experience of greater affective communication with the outside world, the child is subjective to new pressures. Since he is not able to cope completely with these pressures, anxiety arises. Evidence for anxiety, as for greater affective communication generally, is found in the increase in shading. As to the directed drive represented here in steadiness and pressure of line, it appears that the two measures reflect different qualities of the phenomenon of drive. Steadiness is more characteristic of the directedness of the vector, while pressure is more characteristic of the energy or force behind it. The findings on steadiness and pressure may be explained as follows. During the actual process of shock, discharge occurs, dissipating some energy and weakening barriers to the release of further energy. Then, in the immediately ensuing period, while the boundaries are more fluid, further discharge takes place in more directed fashion. Thus, at the second testing both steadiness and pressure are increased. At the third testing the compartmentation and organization has been restored; energy that continues to flow is confined to directed channels as expressed in steadiness; energy as expressed in pressure of line is, however, diminished in force and prevented from breaking through freely as before by the new organization. If we compare this situation with the first testing, the gain in directed energy (steadiness) has been retained, the affective expression (shading) has increased, but the force of drive (pressure) has apparently dropped back to its former level. However, this does not necessarily mean that the situation with regard to pressure is the same at final testing as it was originally. Clinical observation would suggest that the release of aggressive and destructive drives during the electric shock series reduces the accumulated pressure of drives within the child. For example, it has been commonly observed that, in the symptomatology of schizophrenic children, temper tantrums and outbreaks of destructive behavior suddenly occur without apparent sufficient outward cause. The implication is that internal pressures have built up to the point where they explode into action. Assuming that a similar release, but one with somewhat longer-lasting effects, takes place with the shock series, it follows that the pressure should be less afterward. A similar phenomenon has been demonstrated in psychotherapy with schizophrenic children (10) in which hostility and aggression, activated and released in treatment, diminished markedly in the overt behavior of the child. Moreover, *with continued treatment,* clinical evidence strongly suggested that no new accumulation of equal pressure took place.

Discussion of Findings

Let us now bring together the different test findings and the theoretical view as a whole. The first major question is, what is the immediate effect of the electric shock series? Test findings indicate that not only are cognitive organization and compartmentation broken up to some extent, but the organization of attitudes and feelings toward self and objective reality as well. The immediate result is a release of drives, a reduction in awareness of both inner and outer structure and forces alike. With the changes comes a reduction in the experience of frustration, of difficulty in coping with inner and outer requirements, and of resultant anxiety. Likewise, reduced articulation and awareness are manifested in reduced effectiveness of intellectual functioning on tests requiring a higher order of abstraction and generalization. It is again important to note that articulation and awareness of simpler perceptual organizations are not noticeably impaired, nor is the awareness of the body-image significantly changed.

The next question is, what are the factors which influence the direction of the reorganizing process hat takes place between the end of the shock series and the time of follow-up. These facors may be divided into inner and outer influences. The inner influences in the schizophrenic child are of three kinds:

1. The innate process of normal maturation, in which a stable yet growing structure

is built up through which biological and psychological functions are mediated and integrated under a centrally-directed process. This does not mean to imply that high degrees of local process autonomy cannot be achieved at the same time. This innate process may be conceived as a tendency toward a stable yet flexible organization (Schilder's term "Gestaltung" expresses the concept concisely).

2. The schizophrenic disturbance of maturation process, in which occur unequal rates of growth, dominance of a region, part or function which interferes with harmonious development (eg., tonic-neck reflex motility dominance).
3. Constraints of developmental process brought about by those aspects of the pre-shock organization not eliminated in the shock series.

The evidence suggests that electric shock per se does not eliminate factors 2 and 3 above, leaving a *tabula rasa* situation in which a new, good organization comes about by the action of factor 1 alone. It may well be that the reduction of constraints in factor 3 and the possible effects of shock on the process of factor 2 give factor 1 a better chance to operate freely. Of course there is no evidence on this last point but it remains a definite possibility. The important point, however, is that we have little reason, from the data, to assume an automatic good reorganization after shock. Therefore we must conisder the outer influences, and ways in which they can be manipulated to favor the factor 1 process in interaction in the individual case. In this sense, electric shock therapy may be considered less a cure by itself than a procedure which offers an opportunity for a longer-term therapeutic process to operate.

The external influences may be divided into two categories, those dealing directly with the child and those dealing with the child through changes in his environment. Such environmental changes include changes brought about in the social and interpersonal environment as well as in the physical. The effects of group therapy for parents on the child, for example (1), would be included, as well as the effects of physical surroundings, school and other activities (2). The first category of influence is psychotherapy in the broadest sense—tutoring or other forms of work with the child directed to particular areas of functioning (4), as well as individual intensive psychotherapy (9). Thus the question as to the long-term or quasi-permanent effects of electric shock treatment becomes a question of formulating the goals and methods of post-shock treatment of the patient. In the paper just cited, one of the present authors has formulated the goal as follows:

"Therapeutic attempts are generally directed either towards reducing the patient's awareness of the field of forces, increasing the ability to cope with it, or both. Psychotherapy attempts to help the schizophrenic child to cope with the internal and external pressures. The psychophysical relation with the therapist is a major therapeutic factor. The psychotherapist acts as a boundary and at the same time helps the child to establish his own boundaries" (9, pp. 72-73).

In other words, the therapist attempts to take the opportunity affored by the immediate results of electric shock, the weakening of a distorted structure and the release of pressure of drives, to help the child form a more stable organization. The therapist allies himself with the forces in factor 1, seeks to mitigate the disorganizing effects of the forces in factor 2, and to aid in building new constraints to channel these forces more productively than they were prior to treatment. It has been observed that some old constraints remain; one would expect these to be present especially in the regions of more basic attitudes and forms of expression. Since these constitute the child's attempts to cope with pathological process, i.e., his defenses, they can be utilized by the therapist in constructive directions (10). Thus the therapeutic process as a whole consists in aiding and encouraging the building of new boundaries and compartments, in which the compartment of common-sense reality plays the top role in an orderly hierarchy.

In conclusion, it may be remarked that rather extensive implications have been drawn from a study of a small sample of cases. This is true. The purpose of the present paper is less to establish certain facts than to lead to the formulation of more precise hypotheses

that can be tested on a larger, more carefully selected sample. The new studies planned will constitute more than a verification of interpretations given here, however. In such studies, controlled kinds of post-shock treatment will be necessary to provide both a crucial test of the theories and hypotheses offered here, and to articulate as well the relation of psychotherapeutic process to treatments such as the electric shock series.

Summary

The effects of electroconvulsive therapy on schizophrenic children were studied with the use of the Revised Stanford-Binet, the Non-Language Multi-Mental Test of Terman, McCall and Lorge, the Bender-gestalt test, the Goodenough Draw-A-Person test, and a controlled free-drawing called the Trees-Fence-Road test. Tests were administered just prior to the shock series, within 48 hours after completion of the series, and in a follow-up session slightly over a year later on the average. Detailed statistical analysis of test results yielded these findings:

a. Intellectual efficiency was significantly reduced immediately after shock, but recovered by the time of follow-up, in most cases being slightly higher than before shock.

b. There was some evidence on the Non-Language test that logical reasoning processes were differently organized at time of follow-up than before shock.

c. Simple perceptual-cognitive organizing processes are not grossly disturbed even in the testing within 48 hours after the shock series. (It should be noted that Bender and Keeler (6) found the same to be true for those cases which had shown gross disturbances when tested within a few hours after receiving shock.)

d. Changes in the shading, pressure and steadiness of lines in the drawings suggest that shock releases drives and breaks defensive barriers. The same characteristics at time of follow-up testing suggest a reconstruction of barriers and less release of drives, but with a possibility of permanent change in that a limited, directed flow of energy to outside objects is still present which was not found before shock.

e. Pathognomonic signs on the Goodenough and Bender tests are significantly fewer at time of follow-up than at either previous testing.

f. The general interpretation is suggested that the shock series offers a possibility of personality reorganization. Thus other forms of treatment such as psychotherapy could be applied soon after shock to bring about more consistently constructive long-term results than are attained with shock and accompanying care alone.

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THE SOCIAL ADJUSTMENT OF FIFTY PATIENTS IN A CLINIC FOR COMPREHENSIVE MEDICINE[1]

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Perusal of the recent literature reveals an increasing general awareness of the theoretical contributions of social science to psychiatric understanding (5, 10, 11, 25, 26) as well as the beginnings of research efforts to develop sociological techniques and criteria useful in clinical work with patients (6, 8, 23, 27, 28). In the psychiatric team today (13, 15, 21) the clinical work with paitients (6, 8, 13, 27, 28) clinic social worker employs concepts and methods which are borrowed from medicine since present sociological techniques have seemed ill adapted to the clinic setting. Hunt and Kogan have demonstrated that trained social caseworkers tend to include social adjustment criteria in assaying "movement" in a case but tend also to neglect accurate data about the environment in favor of analyses of interview behavior and character structure (12, p. 36). A noteworthy paper (19) by Miles, Barrabee and Finesinger has demonstrated the applicability of sociological concepts to the problem of evaluating the results of psychotherapy. The Barrabee-Finesinger Social Adjustment Scale, which investigates by means of scored interview data the degree to which an individual has met his own self-expectations and society's standards for occupation adjustment, economic status, family life and community participation, provides the social worker with a tool for making a truly "social diagnosis".

In the past other investigators have carried out evaluations of the social adjustment of psychiatric patients within various settings by employing a variety of criteria and methods. Ratings of social adjustment or social behavior have frequently been included within hospital behavior inventories. Scales described by Rowell (22), Wittenborn and Mettler (31), Malamud and Sands (17), Gardner (30) and Cohen, Malmo and Thale (7) contain such criteria and are used by personnel who directly observe patients from day to day. Another promising approach has been to place a patient in standardized situations in which certain aspects of social behavior may be observed and quantitated, as illustrated by Hyde's studies of behavior in the occupational therapy setting (13). Among the common psychological inventories of social adjustment applicable in the outpatient setting may be mentioned the California Test of Personality (14) and the Vineland Social Maturity Scale (16). Of these, the Vineland Scale bears some similarity to the Barrabee-Finesinger Scale since both employ the interview method. Indeed as implied in a recent paper by Auld (2), many psychological instruments rest in part upon social adjustment criteria.

Quantitating social adjustment information obtained by the interview method has been attempted before. For example, Gerard and Siegal in a study of the family background of schizophrenics (9) assigned numerical values to the maternal, paternal and sibling relationships. Likewise Watson and Mensh's research design for evaluating psychotherapy contains quantitative assessments of environmental factors (29, p. 287). The Barrabee-Finesinger Social Adjustment Scale, however, differs from these by using, instead of psychiatric criteria, conventional American cultural standards and individual self-standards as the two criteria for social adjustment (4). It is believed that these pragmatic criteria are implicit in many day-to-day clinical decisions of psychiatric practitioners and their patients. If this be true, data derived from such a frame of reference may be more readily understood by patients and utilized in therapy with them.

A further refinement (table 1) of the Barrabee-Finesinger Social Adjustment Scale (3) was utilized in the present project as part of the intake procedure for patients referred to a

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TABLE I—BARRABEE-FINESINGER SOCIAL ADJUSTMENT SCALE

Name: Date:
Sex: Age: Interviewed by:
Address: Remarks:
Telephone:

	Categories	*Scores*
I.	EMPLOYMENT ADJUSTMENT	———
	A. Time Spent on the Job	———
	B. Job Changes	———
	C. Job Satisfaction	———
II.	ECONOMIC ADJUSTMENT	———
	Ratio of Income to Expenses	
III.	FAMILY ADJUSTMENT*	———
	A. Family of Procreation	———
	1. Marital	———
	2. Child	———
	3. Home Responsibilities	———
	B. Family of Orientation	———
	1. Parental	———
	2. Sibling	———
	3. Other Relatives	———
IV.	COMMUNITY ADJUSTMENT	———
	A. Sociability	———
	1. Number of Friends	———
	2. Frequency of Visiting with Friends	———
	3. Satisfaction with Friendship	———
	B. Group Participation	———
	1. Frequency	———
	2. Satisfaction	———

* For unmarried persons assessment was limited to relationships with parents, siblings, home responsibilities and other relatives.

psychosomatic clinic. It has been our hypothesis that data obtained through such a social diagnosis would correlate with certain diagnostic information collected by the psychiatrist. In a clinic which is devoted to diagnosis of disorders with multiple etiology and to flexible psychotherapeutic treatment, any technique which adds a new diagnostic dimension may well lead to improvement in the reliability (1) of the intake evaluation. More specifically we have entertained the notion that, just as patients suffering certain symptomatology frequently show rather characteristic interpersonal attitudes and characteristic defenses against anxiety-provoking stimuli, so patients within a diagnostic category would show quantifiably distinct patterns of social adjustment. As examples, it may be hypothesized that a direct relationship exists between psychosis (as diagnosed by the psychiatrist) and a low sociability score, that patients with psychosomatic disorders tend to maintain high employment and economic adjustment scores in the presence of poor family adjustment or that a direct rela-

tionship exists between severity of psychiatric illness and social adjustment. Granted that certain of these relationships are "known to be true" on the basis of clinical experience, to begin to demonstrate them more definitively is our purpose.

Method

Selection of Patients. Patients visiting Washington University Clinics for the first time are screened to ascertain their financial status and are admitted if they are unable to afford a private physician. It is noteworthy that, since private psychiatric fees are high, persons admitted to the psychiatric clinic tend to include members of a higher economic group than the average clinic patient.

Generally patients receive a diagnostic evaluation at the hands of an internist who then refers those believed to require psychiatric investigation to the Clinic for Comprehensive Medicine. As a result of variation in the internists' level of psychiatric sophistication, a considerable variety of problems is referred and variation is present in the degree of patients' preparation for and acceptance of this psychiatric referral. A two-week period awaiting appointment to this clinic at the time this project was carried out selectively eliminated all acute psychiatric emergencies.

The Psychiatric Evaluation. Patients thus referred are interviewed for from 40 to 60 minutes by an experienced teacher of psychiatry before a small group of trainees in psychotherapy including frequently a nurse, social worker, medical student, medical intern and psychiatric intern (24). Following each interview the group discusses the case and on the basis of all medical and psychiatric data available a diagnosis is determined. Finally an anamnesis stressing the evolution of present symptoms and disabilities followed by a comprehensive diagnostic formulation is entered in the clinic record by the interviewer. With patients who accept further investigative interviews or psychotherapy, records of interview content and behavior are entered in the chart and provide even more complete information.

The Social Evaluation. Immediately prior to or shortly after the psychiatric interview, each patient was seen by one of the authors. We explained that our purpose was to obtain "additional information about your life which will help the doctor to help you" as well as to gain greater understanding of the ways the clinic is of service to patients. At this time patients' cooperation in a follow-up study (to be reported later) was also solicited. All patients agreed to take part in the initial study.

In the social adjustment interview we aimed at establishing only sufficient rapport that the subjects could describe, as they perceived them, the reality circumstances of their day-to-day living. During the first portion of the interview we obtained identifying data (age, sex, marital status, years of schooling, religion and occupation) as well as simple indices of overall social adjustment (mobility, living arrangements, number of people interacted with each day and percentage of the day spent with others). The second part of the interview was devoted to the Barrabee-Finesinger Social Adjustment Scale.

In administering the Barrabee-Finesinger interview the question-answer approach was avoided and a directed discussion was stimulated during which a series of leading questions was posed in order to reveal in the patients' own words the specific information (table 1) to be rated on the scale. Information was obtained in this manner about the patient's job adjustment, financial situation, relationships with all members of his family and participation in any group outside of job and family. In assigning values to these data, each area of adjustment was rated on a five-point scale. The criteria chosen for the "ideal" adjustment (rating of 5) were of two types: (1) a generally accepted modern American cultural ideal, or (2) the patient's own self-expectation. For each area investigated, items using both these criteria were included. For example, in evaluating employment adjustment, the cultural ideas of (A) holding a full-time steady job and (B) changing positions only for a better job were chosen, as well as (C) the patient's own statement about his degree of job satisfaction (table 2). Similarly, in assessing the marital relationship, the cultural ideal of both partners sharing similar views concerning the major aspects of living (child care, finances, friends, management of home,

TABLE II.—SAMPLE SCORING METHOD

I. EMPLOYMENT ADJUSTMENT*

A. Time Spent on Job:

Criteria for Ratings	*Rating*
Full time job, works steadily.	5
Full time job, works steadily, short periods of time off regularly. ¾ time job, works steadily.	4
Full time job, frequent days off regularly. ¾ time job, works steadily, short periods of time off regularly. ½ time job, works steadily.	3
Full time job, extended periods of time out. ¾ time job, frequent days off regularly. ½ time job, works steadily, short periods of time off regularly. ¼ time job, works steadily.	2
not working.	1

B. Job Changes:

Criteria for Ratings	*Rating*
Changed only for better job, or no change.	5
1 or 2 changes for equal job.	4
3 to 6 changes for equal job. 1 or 2 changes for poorer job.	3
3 to 6 changes for poorer job.	2
Constantly changing jobs (6 or more)	1

C. Satisfaction:

	Satisfied	*Neutral*	*Dissatisfied*
With type of work	1	½	0
With working conditions	1	½	0
With rate of pay	1	½	0
With relations with others	1	½	0
With adequacy to job	1	½	0

I.C. — Satisfaction Rating = + =

Scoring:

	Rating	×	*Weight*	=
I.A.		×	7	=
I.B.		×	1	=
I.C.		×	2	=

Total = ——— = (Employment Adjustment Score)
10

* For complete scale and scoring method, see instruction manual (4).

religion, etc.) was used, as well as such items as how satisfied the patient was with his marriage and to what extent he believed he was in love with his partner.

Before attempting correlation and comparison of social with psychiatric factors, both the clinic psychiatric and medical records and the data from our own social studies were reviewed by the authors for each individual patient. Hypotheses regarding the relationship of social to psychiatric forces in each patient's illness were formulated. Where possible these hypotheses were tested with the present sample.

RESULTS

Description of the Sample. The procedure of an initial psychiatric interview carried on in a group setting followed shortly by the Barrabee-Finesinger interview was applied to 50 consecutive referrals (made to Medicine "D" Clinic, Washington University Clinic, St. Louis, Missouri) between September and December, 1950. The diagnostic classification of these patients is based upon all psychiatric and medical data available including information obtained during psychotherapy. The diagnosis

was made, however, without reference to social adjustment scores. The average age of the group was 37.8 years; the average years of schooling 9.0 years. As regards occupation at the time of the first interview, approximately one-third were housewives, one-third were unemployed and one-third engaged in middle- or lower-class employment. Seventy-two per cent were married and only two patients were not residing at home with their own families.

The majority of patients were labeled psychoneurosis. Many of those patients had somatic symptoms and initially believed themselves suffering primarily from a physical illness; they were not classified as psychosomatic illness, however, unless a physiological dysfunction remained the primary problem in the opinion of the physician. Among prominent symptoms it is interesting to note the prevalence of depressive feelings, underactivity and physiological manifestations of anxiety. Despite the fact that this sample was drawn from the population of a "psychosomatic clinic" the incidence of psychosomatic disorders is only one-fifth; in addition the group of severe disorders—personality disorders, intellectual deficiency and psychosis—constitutes an equally large portion of the sample. For the most part we observed that these individuals concentrated on physical complaints and denied their psycho-social conflicts. Finally it should be noted that although thirty-six patients were experiencing illnesses of less than a year in duration, fourteen classed as chronic illnesses were available for study.

Definitions. Recent illness: symptoms began or increased markedly during the past year. Chronic illness: symptoms over 1 year's duration and not markedly worse the past year.

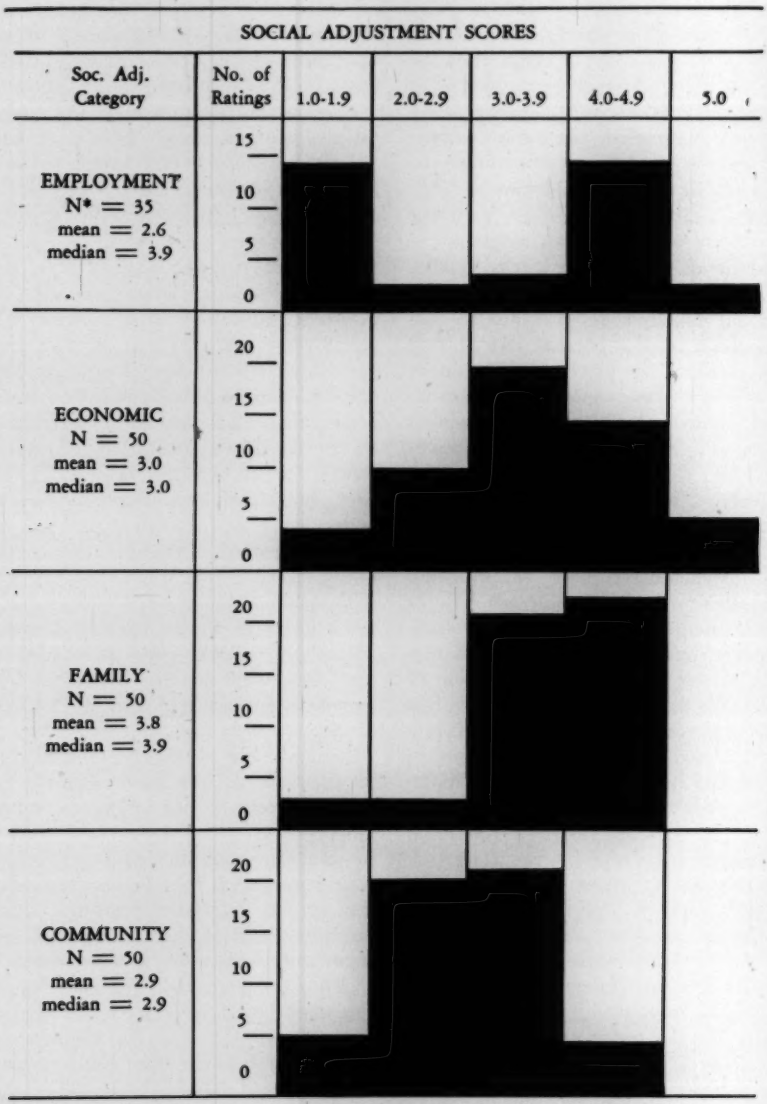
Social Adjustment Ratings of the Total Group. The Barrabee-Finesinger social adjustment scores for the group as a whole record the distribution of various types of social adjustment within this clinic population. Figure 1 reveals a biphasic distribution of employment scores and monophasic score distributions for the other three areas of adjustment. Although these scores will be interpreted by referring to psychiatric data, the possibility should be kept in mind that the structure of the scale itself and cultural factors may be determinants in some instances. Worthy of notice are the large proportion of patients with poor employment adjustment, the centrally distributed economic adjustment scores and the absence of patients who fully achieve both cultural and self-standards for family and community adjustment.

Employment Adjustment. Forty per cent of patients who expected themselves to work (N—35) were prevented entirely (score=1.0) by psychiatric illness. Only 6 per cent of the entire sample claimed ideal adjustment in their jobs. Worthy of comment is the fact that 80 per cent of patients diagnosed as having a *psychosomatic illness* rated above 4.0 (i.e., employment difficulties were judged relatively mild) whereas 83 per cent of those diagnosed *personality disorder* and 75 per cent diagnosed *psychosis* fell into that group who were rated under 4.0 (i.e., judged to be suffering moderate to severe difficulties in employment adjustment). All the patients believed clinically to have intellectual impairment obtained ratings under 4.0. Distributed with approximately equal frequency throughout the employment rating scale were the *psychoneurotic* patients.

Economic Adjustment. The economic adjustment scores shown on figure 1 illustrate that only three patients were financially 100 per cent dependent on others (score=1.0), ten patients were unable to earn 50 to 90 per cent of their expenses (score=2.0), and 19 patients were dependent on others for amounts up to 50 per cent of their financial needs (score=3.0). A mere 36 per cent were economically independent (score=4.0) or able actually able to save money (score=5.0) at the time they were interviewed. The housewives included in this analysis, interestingly enough, showed essentially the same distribution of economic status as the remainder of the sample.

A statistical analysis was made of the difference in Economic Adjustment scores between the various psychiatrically diagnosed groups. Differences between the group means were computed and Fisher's t-test (18) applied to test the significance of the differences.

Three of the ten mean differences analyzed in this way attained a significance greater than would have been predicted on the basis of chance alone. The mean Economic Adjustment score of 3.7 for the Psychosomatic group was significantly higher than the mean score of 2.17 for the Personality Disorder group, the probability that such a difference would have oc-



*Housewives who did not expect normally to be employed were not rated.

FIG. 1

curred by chance alone being once in a thousand times. The mean score of 3.26 for the Psychoneurotic group also was significantly higher than the mean score of 2.17 for the Personality Disorder group, such a difference would be expected to occur by chance once in 20 times. The Psychosomatic Illness group mean of 3.7 was significantly higher than the Intellectual Defective group, this difference expected to occur by chance once in 13 times. Thus, there is a true discrepancy in the economic adjustment rating of patients diagnosed as having

psychosomatic illnesses and psychoneurosis, and those classified as suffering from personality disorders. Likewise, there is a real difference between the psychosomatic patients and the intellectual defective patients as manifested in their economic adjustment scores. These findings generally are in line with the theoretical expectation that patients suffering from the more severe psychiatric disorders (personality disorder, intellectual defective, psychosis) will be more socially maladjusted in the economic area than those displaying psychosomatic and psychoneurotic symptoms.

Family Adjustment. The overall spread of family adjustment values placed 92 per cent of patients in the narrow range between 3.0 and 4.9, with the median for the entire sample being 3.9. It is our impression that this high incidence of superior family adjustment scores reflects the prevalence of efforts to preserve harmony with family members even at the cost of suffering and disability. Further comparative studies are required, however, to establish this interpretation. In view of the fact that these individuals were universally afflicted with disturbances in interpersonal relationships, it is not surprising that none achieved a family score of 5.0; on the other hand, since inquiries into family adjustment were more numerous and more detailed than into other areas, the scale structure itself may tend to mediate against extreme high or low scores.

Forty-one patients had relatives in both their family of procreation and their parental family; of these 76 per cent maintained a better social adjustment with the parental-sibling environment than with the marital-child environment. With many patients we observed unresolved anxieties based upon the parental relationship being dramatized within the marital or patient-child relationships.

Category	*Mean Score (N—41)*
Adjustment to spouse, children, home responsibilities	3.66
Adjustment to parents, siblings, other relatives	4.24

(These scores are significantly different at the level of .001.)

Furthermore, the psychiatrists very commonly noted as prominent problems unresolved dependency and inability to accept adult responsibilities. This clinical observation was corroborated by comparison of the sub-categories of the family adjustment scale; the lowest subscore for any portion of the family adjustment inquiry was obtained for adjustment to home responsibilities.

Community Adjustment. The distribution of community adjustment scores (figure 1) is clarified if participation in community groups is considered separately from participation in friendships. These people—for the most part laborers, unemployed and housewives—frequently stated that they did not expect to participate in endeavors outside of home or job and would not do so were they feeling well. Thus the fact that 70 per cent scored below 1.5 for community group participation seems more related to cultural self-expectations than to any psychiatric disability.

The hypothesis that patients who had few friends, socialized infrequently and admitted little pleasure in sociability would suffer from more serious psychiatric disorders than those whose scores were above the mean score for sociability (mean=3.4) was confirmed. Consistent with this hypothesis is the finding that all psychotic patients in our sample scored below 2.0. Although a majority of patients diagnosed personality disorder or intellectual impairment and a minority of patients diagnosed psychoneurosis or psychosomatic illness scored below the mean for this category, sociability scores did not seem to be diagnostically discriminating except for psychotics.

The Extremes of Social Adjustment

Of the 50 patients interviewed, eight scored below the mean in all four major areas of social adjustment and fourteen achieved scores above the mean in all areas. The low group is composed of four men and four women, the high group of five men and nine women. The average age of the two groups is approximately the same; average schooling for the low group is 8.5 years, for the high group 9.4 years. Low scoring patients spent less than half their time with others. Included in the low group are four who were married, one divorced, one separated, one widowed and one single person, whereas the high group included twelve married and two single persons. To illustrate the differences between these two ex-

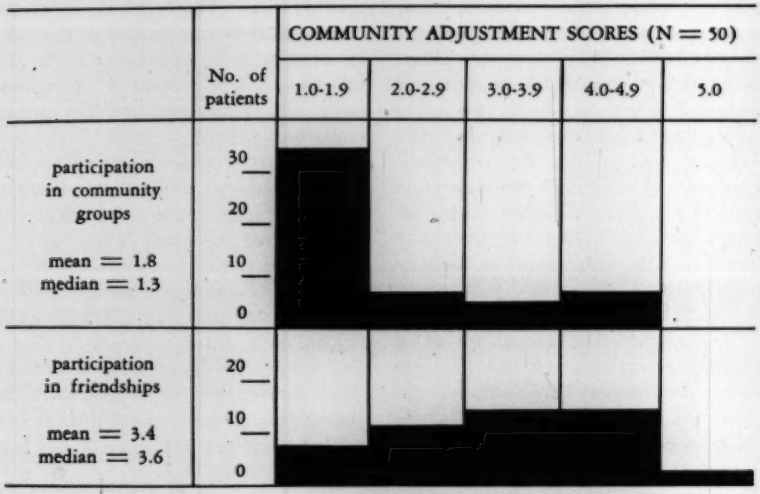


FIG. 2

treme groups, a case abstract is presented from each group.

Mrs. S. Employment, no score; Economic, 3; Family Life, 2.7; Community, 1.7.

Mrs. S. is a 50-year-old Negro woman who has pulled out pieces of her hair during the past two years and says she has stored all her hair in bags at home. During the interview she wore a red bandana which she said protected her "moth-eaten" hair. She washes many times a day, hasn't slept a full night in six months. She has been increasingly depressed during the past two years and wept bitterly as she related that she had completely "lost her nature."

Eight months ago while staring in the mirror she first saw little "star-like" animals crawling in her hair. She frequently sees them crawling on her fingers and then burns them. During the interview she was able to see these bugs although no one else was able to see them.

It was learned that the patient's symptoms started when she and her husband moved into a white neighborhood and she began having difficulties with the neighbors. These have so increased that she now believes her neighbors and the people in her church are persecuting her.

Past history revealed that she was one of eleven children. She was married at age 17 and left her husband, who had been chosen for her by her father, after three years. Her second husband died after fifteen years of marriage. She married her present husband when she was 45 and there was no evidence of marital discord.

The patient's diagnosis was described as being a schizoaffective psychosis with both paranoid and depressive trends. She agreed to return to the clinic, but thought only some magic ointment would be effective in destroying the "bugs."

Miss R. Employment, 4.5; Economic, 5.0; Family, 3.9; Community, 3.3.

Miss R. is a 43-year-old white single woman whose presenting complaint was urticaria. In addition she gave a history of intermittent "nervous indigestion," bloating, belching and nervous tension of moderate severity which had been increasing during the past year.

She stated that she was born on a farm and had had a happy childhood. She attended a state university for three years, majoring in education. Following this for twelve years she taught in a junior high school. In 1943 she enlisted in the W.A.C. and went through O.C.S., being separated from the service three years later with the rank of Captain. At the time she was interviewed she held an administrative position with the Veterans Administration.

In speaking to the psychiatrist she expressed dissatisfaction because she had no contact with men and she felt that some of her family ties were so strong as to prevent her from participating in outside activities. On several occasions urticaria had appeared at a time of disagreement with her mother. Psychotherapy was advised; she expressed fear of revealing intimate conflicts but agreed to return once, although she felt allergy treatments were more beneficial.

An analysis of the diagnoses within these two groups suggests the discriminatory values of such mean social adjustment scores. Contained within the low group are the total aggregate of mentally retarded individuals and half the personality disorders. The psycho-

neurotic patients are totally excluded. All these patients complained of chronic illnesses and, except for one instance, they had suffered no recent exacerbation. One patient with all social adjustment scores below the mean for the sample suffered from chronic asthma and a recent grief reaction.

Of the 14 patients who scored uniformly above the mean, eight were diagnosed psychoneurosis and the remainder psychosomatic illness. Worthy of note is the fact that a majority of the total number of psychosomatic disorders is included here. In addition, we were impressed that all patients displaying prominent obsessive tendencies were to be found within this high group.

Review of the four psychotic patients demonstrated that, whereas three who clinically were judged to be either experiencing onset of psychosis or beginning remission from psychosis had a variable social adjustment profile, the one patient who clinically was judged to be most chronically disturbed had uniformly poor scores in all areas. In summary, a high correlation was discovered, first, between chronic severe ambulatory psychiatric disease and uniformly below-average social adjustment and, secondly, between psychoneurotic or psychosomatic disorders of recent origin and uniformly above-average social adjustment.

Discussion

Growing experience with anthropological concepts and techniques employed in clinical psychiatric practice has demonstrated much of value to both psychiatric evaluation and to psychotherapy. Recently Pollak and others (20) have showed with detailed case material how a thorough consideration of the cultural standards of a patient's family, his national origin, religious heritage and particular age group is often necessary before a realistic treatment plan can be formulated. Both normal and neurotic behavior must be assessed in the light of such knowledge since the expectations of one subculture are deviant in another. Placed between the social sciences on the one hand and medical practice on the other, social service workers would seem the proper purveyors to clinical work of social science techniques. Indeed such techniques would seem to be the natural means for social workers to make many unique scientific contributions. Yet heretofore few social science techniques have been available which promised much direct clinical applicability.

The present work illustrates the use of a weighted social adjustment interview as part of the evaluation procedure in a clinic for psychosomatic disorders. The relationship between psychiatric and social factors was studied in the belief that such relationships, when clearly defined, might eventually provide reliable diagnostic, prognostic and therapeutic indicators. Based upon widely held social "ideals" expressed in concrete terms, the scale may be applied by both experienced and inexperienced interviewers. As Zubin has clearly stated (32), although the interview method is subject to numerous sources of error, no other method is better adapted for eliciting the patient's own attitudes toward his difficulties. Since this scale seeks as one of its aims to quantitate such attitudes, the interview method would seem appropriate to our study. Nevertheless it must be confessed that valuable data would be added if it were feasible, within the temporal and financial limitations often placed upon a busy out-patient department, to make controlled observations of patient's social behavior.

Socio-psychiatric study of 50 outpatients has suggested a series of hypotheses. The hypotheses themselves are not new but the method used in reaching them, based upon a sociological frame of reference and permitting of quantitative comparisons, is deemed to define them more explicitly than by the usual clinical approaches.

1. Chronicity of psychiatric illness is strongly related to poor overall social adjustment.

2. Mild psychiatric disorders are rarely, if ever, associated with universally poor social adjustment; serious psychiatric disorders are rarely, if ever, associated with universally good social adjustment.

3. Psychosis is more apt to be accompanied by isolation from friendship than other psychiatric syndromes.

4. Social characteristics of psychoneurotic patients studied as a group by this method are highly variable.

5. Obsessive traits and unusually good employment, economic and community adjustment

characterize many patients with psychosomatic illnesses. This high social conformance is apparently related to a frequent inability to express socially-unacceptable impulses. The common observation that simple social reeducation and catharsis leads to some improvement in physical symptomatology is consistent with this finding.

6. Lower middle class midwestern adults do not expect themselves to participate actively in community affairs.

Finally, from the data herein, interpretations about the employment, economic, family and community adjustment of this entire group of lower middle class midwestern adults can be suggested. Much needed to clarify these interpretations, however, are similar projects with patients from other socioeconomic strata, patients with medical and surgical conditions and individuals without disabilities. In addition, since scores are influenced strongly by the weighting system for combining subscores, a controlled investigation of this system must eventually be undertaken. Nevertheless it is our impression that the present form of the scale expresses with accuracy most persons' social functioning according to modern American cultural goals. A one year socia-psychiatric follow-up study which is now in progress promises to shed further light on environmental forces which influence the course of psychiatric illness. Such a simple quantitative instrument which expresses personality functioning in generally-accepted social terms seems likely to increase the adequacy of clinical research.

Summary

The Barrabee-Finesinger social adjustment interview is an instrument which provides a comprehensive impression of social adjustment expressed in quantitative terms. The instrument is constructed upon sociological concepts and is well adapted to the clinic setting. As such it adds a valuable technique to the social worker's armamentarium and broadens the frame of reference of the psychiatric evaluation. The present study illustrates the use of this scale as part of the diagnostic evaluation of patients attending an urban midwestern clinic for psychosomatic disorders.

Analysis of 50 consecutive referrals revealed the following:

1. Such patients tend to be afflicted with psychoneurotic disorders of less than a year's duration and tend to be driven to seek medical aid by somatic discomforts or interferences with employment and economic self-sufficiency. Most are unaware of major emotional difficulties with their immediate families and even less aware of important conflicts with parents or siblings.

2. Psychiatric illness of over a year's duration correlates highly with social adjustment ratings which are below average in all areas.

2. Patients diagnosed as psychosomatic illness tend to preserve better adjustment than others except in family relationships.

4. The combination of infrequent socialization, a limited number of close friends and low satisfaction from friendships may in itself be a social syndrome indicative of psychosis.

5. The observation that these patients participated little in community group activities is apparently related to cultural standards rather than psychiatric disability.

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PSYCHIATRIC POTENTIALITIES OF ART

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This paper is presented as a reiteration and summary of the role of art in psychiatry, art here referring to the productions of psychiatric patients with no necessary esthetic implications intended (a distinction not always explicit in psychiatric studies).

As a preliminary observation, it is well to recall the distinction made by Fry (5) between the psychoanalytic approach to art and the esthetic approach, the former concentrating on the choice of objects or content of a work (not quite true perhaps as will be indicated in the discussion of the synthetic function of art), whereas the latter is concerned only with the mode of presentation, the contemplation of formal relations. Fry declared (5), "In a world of symbolists, only two kinds of people are entirely opposed to symbolism, and they are the man of science and the artist, since they are seeking to make constructions which are completely self-consistent, self-supporting, and self-contained—having ultimate value." This rather austere theoretical approach Fry formulated emphasizes the technical and formal aspects of art and presents the association and emotional responses to an art production as evanescent and unessential to esthetic appreciation. Accordingly, one's esthetic experience is heightened by familiarity with a work of art, whereas the fantasy or psychological overlay tends to disappear. Both the artist and the scientist are concerned with theoretic formal relationships rather than fantasy and wish fulfillment.

Fry modestly stated (5) that he was dogmatic in declaring the esthetic emotion to be one concerned with form and aroused by the recognition of formal relationships. His emphasis on "significant form" however is dialectically apropos because such a thesis is at times neglected in psychiatric approaches to art.

It is interesting to note Northrop's (13) distinction between the theoretic component of knowledge and the esthetic component. His scholarly thesis (hardly amenable to a paragraph summary) is based on a comprehensive review of the philosophical determinants of Eastern and Western ideologies and their actualizations in the respective cultures, particularly in the fields of political science, religion, art, and economy. The theoretic component is characterized by science with its concepts by postulation, whereas the esthetic component deals with the intuitive immediacy of apprehendable nature either as discrete data (Occidental) or a continuum (Oriental).

Northrop's approach may be likened to that of Langer (10) who categorizes symbolism as discursive (propositional and syllogistic) and non-discursive (the sensory appreciation of forms), the latter being characteristic of artistic and religious activity.

Langer also notes (as does Fry) that the psychoanalytic (Freudian) theory of esthetics is unable to differentiate between good and bad art, a capital comment which points out the inadequacies of such a doctrine.

Cassirer (3) (whose contributions to symbolic philosophy warrent careful consideration by those interested in symbolism) distinguishes between art and science with art giving order to the apprehension of sensory appearances and science giving order to the conceptual aspects of experience, the theoretical components.

Although Northrop, Langer, and Cassirer present the content of art and science as that of percept and concept respectively, they along with Fry recognize a formal element which imbues artistic endeavor with something more essential than wish fulfillment or fantasy. Indeed, the allusions to the fertile fantasy of the mentally ill could well undergo some critical evaluation.

Fry also distinguishes (5) between the origin of a production and its function, a differentiation at times overlooked in psychiatric evaluations of art, and he points out that the origin does not explain the function—a distinction also made by William James (9), who termed the former inquiry of origin an existential judgment (no connection whatsoever with existentialism) and the latter evaluation of significance,

a proposition of value, a spiritual judgment. James states, " . . . the existential facts by themselves are insufficient for determining the value; and the best adepts of the higher criticism accordingly never confound the existential with the spiritual problem."

It would seem that the psychiatric and esthetic critiques of art are not identical; and even if one subscribes to an esthetic of the wish-fulfillment type, such a theory is inadequate to cope with all aspects of art.

Psychiatry is concerned with what I shall refer to as the analytic and synthetic functions of art. These, although closely interwoven, will be elaborated separately. No attempt will be made to survey the literature on art in psychiatry as it has been recently reviewed by Anastasi and Foley (1).

The Analytic Function of Art

By the analytic function of art, I refer to its utilization as a diagnostic procedure in evaluating a patient's illness and the dynamics of the disturbance. One of the first investigators to emphasize this approach in the United States was Lewis (11), who noted that the content of art productions may be interpreted at three levels: the manifest content, the latent content, and the deductive or derivative meaning. He observed that a production may indicate the status of transference and have prognostic value. Several recent papers illustrating the value of these factors are listed in the bibliography (2, 4, 6, 12, 14).

The article by Erickson and Kubie (4) describes how a repression was brought to light in a relatively short time with the aid of automatic drawing; whereas, a much longer time might have been required via psychoanalytic technique.

Art is particularly apt as a short-cut to the unconsciousness because its non-discursive symbolism (10) expresses, at times, the locus of conflict or its nature very succinctly; the same material is elicited by psychoanalysis only after a prolonged circuitous approach. This may be summed up by the response of a deteriorated catatonic schizophrenic during a group art therapy session, when asked the function of art. He replied that, "It is useful in saving a lot of unnecessary explaining and talking . . .," and a depressive patient added, " . . . a picture is worth a thousand words."

In the art productions of patients, the content often reveals, or conveys, a feeling tone which is difficult to extrapolate into language without divesting it of much impact.

The content of a production may be manifest, latent, or derived (11). The derived content (which may be considered as latent content emerging from the "deepest" unconsciousness) is interpreted through the recognition of universal symbols scattered throughout mythology, the art of primitives,[1] alchemy, religious symbolism, etc. White (16) has written, " . . . in the proportion that we sound the ultimate depths of the unconscious do we approach a symbolism which is universal in its meaning." This is valuable in interpreting the content of patients' productions; although, as White admonishes (16), " . . . no matter how profound and universal the meaning may be, it is always clothed in the individual's personal experience."

Several symbols, often assumed to have a universal significance, have variegated meanings, some of which are diametric. For example, the snake, commonly regarded as a male phallic symbol, also has symbolized wisdom, solar rays, rebirth, immortality, death, and the *feminine* principle (7). It is true that some symbols, such as the triangle, circle, square, and crescent, tend to have a constant meaning universally encountered amongst all races and ages; but even these symbols may have an accidental or private connotation to the individual quite different from the usual meaning.

The therapist must avoid any procrustean interpretation of symbols; indeed, the interpretation should be contingent in most instances on

[1] A term much abused in psychiatric literature where one finds, for example, much of schizophrenic ideation "explained" as a regression to that of primitive man—an idea which some anthropologists would receive rather inimically. As used here, primitive refers to those cultures without a written language.

The art of primitives is not inferior esthetically to that of our culture as evidenced, for example, by the beautiful sculpture, drawings and paintings of paleolithic man during the Aurignacian and Magdalenian "cultures".

The use of the term "primitive" with the implication that an evolution has occurred in man from a lower sensibility to a higher is unwarranted as applied to art.

the patient's associations and his personality, as well as his education. Often, this process of interpretation involves a constant shuffling of the therapist's prejudices; and the physician may find himself, frequently, projecting his own associations and erudition into the symbols under consideration, at times unconsciously insinuating his interpretation into that of the patient.

Obviously there are many potentialities in this use of art; an interesting one being presented by Auerbach in his paper on "doodling" in neurotics (2) illustrating its diagnostic and, in several instances, its prognostic value.

Characteristics of art productions which identify the illness may be noted; although given a production it is difficult, at times, to make a diagnosis. As might be expected, the characteristics usually most valuable are graphic evidences of symptomatology. For example, the productions of schizophrenics may illustrate perseveration, contain neulogisms, portray delusions or hallucinations, be bizarre or stereotyped, evidence verbigeration and the colors are often blatant as contrasted, for example, with the more sombre choice of a depressive. One of my schizophrenic patients covered six sheets of paper with fine pencil marks which he described as a new language.

During my admission interviews,[2] the patients (all males) were requested to draw a man, woman, girl friend or wife, and their parents. In addition, each was asked to write a short statement giving the reasons for hospitalization and given the opportunity to participate in a group of patients interested in art. Attendance was supplemented by several chronic schizophrenics who expressed a desire to attend. The group met daily, when feasible, and was organized and directed to a large extent by the patients, several having had previous training in art.

The routine drawings were requested of all patients and some were elicited only after some insistence—this never, in my experience, aggravating the illness; although conceivably it might if not done discreetly or if pressed in a patient whose illness was associated in any way with art.

[2] This study done on the West Lodge service of Saint Elizabeths Hospital, Washington, D. C.

The following material illustrates the analytic function of art. The first three figures were produced by a 30-year-old unmarried Negro, a voluntary admission with training as a commercial artist who sought psychiatric aid because, "... I thought everyone was saying I was a freak ... everything connected with sexual perverseness was obnoxious and bad—if anything like that happened to me, I don't know what I would do ..."

This patient presented a paranoid schizophrenic setting with an obvious homosexual conflict in the foreground. Shortly after admission, he was discharged against medical advice. During his brief stay in the hospital, he was seen by me for one interview.

Figure 1 is his drawing of a man and woman, the latter a rather stereotyped and unrevealing figure but the former presents several interesting features. Foremost is the difficulty encountered with the left eye—erasing and redrawing it (nearly plucking it out!). The hat was added as an afterthought, as was the pipe and left ear. The symbolic import of the left as the evil, *sinister*, and feminine side needs no reiteration. The hat and pipe were added perhaps to strengthen the masculinity of the figure.

This drawing suggests that the patient was having difficulty with his left side; i.e., his femininity, the "evil" aspects of his personality, and homosexuality. These inferences were all corroborated by interview.

Figure 2 portrays his girl friend—a marked contrast to the more appealing feminine figure his is capable of drawing—originally it was even more epicene until he added a breast as an afterthought. The figure conveys a marked apathy apropos of his "girl friend", again indicating his homosexual proclivity.

Figure 3, representing his parents, need little comment—it would be an ideal frontispiece for a text on the domineering mother!

These drawings vividly portray his conflicts with homosexuality and the lack of a satisfactory heterosexual relationship along with indicating the parental source of much of his difficulty.

The day of discharge, this patient went home, talked with his *mother*, walked upstairs and put a bullet through his head, thus successfully committing suicide.

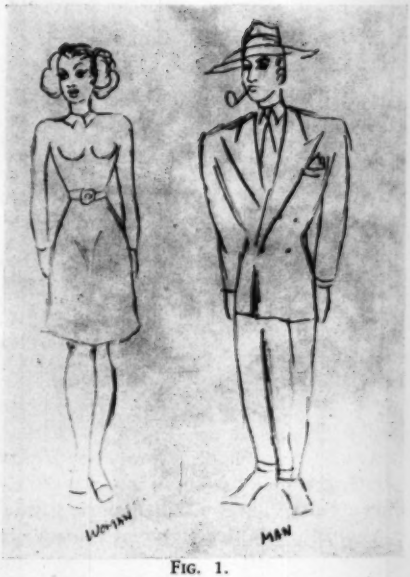

FIG. 1.

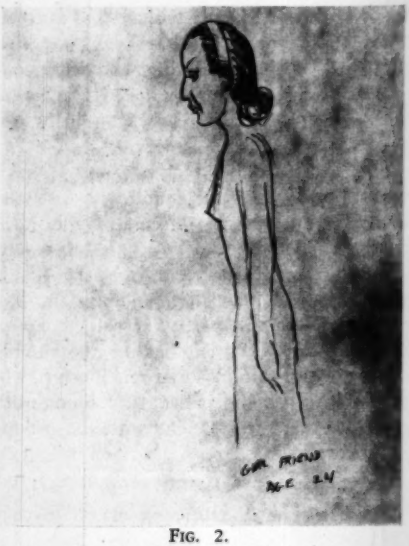

FIG. 2.

Figure 4 is a watercolor done by a hebephrnic patient who was asked to paint his mother—this painting portrays his mother in a coffin, an overt death wish. Close examination will reveal an outline of her head in the head of the coffin, as well as marks on the side of the coffin described by the patient as "her talon-like hands".

FIG. 3.

FIG. 4.

THE SYNTHETIC FUNCTION OF ART

The synthetic value of art lies in its therapeutic and rehabilitative potentialities.

First, and often foremost, it provides the interviewer and the patient with a common denominator for discussion, a valuable factor in the treatment of most patients, especially depressives and schizophrenics, for it provides them with a "stake in reality" which can be used to educe the patients into objectivity.

Huntoon (8) described several categories of the function of art therapy including fantasy or wish fulfillment, dexterity, relief of anxiety through the representation of conflictual material, and the externalization and mastery of subjective thoughts and emotion—these all fall within the synthetic function of art.

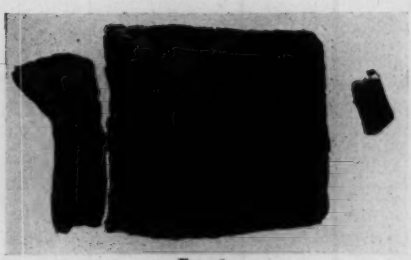

FIG. 5.

Taylor (15) distinguishes between the objective and subjective forms of expression, the former describing the patient's recognition of actuality, his material surroundings, and consciously with whatever art instruction with it his creative expression is developed he can accept and with whatever extension of the sense of order inherent in art can be achieved. He also states (15), ". . . art (is) a positive and civilizing thing . . . in this use of the sensual, the intellectual, and the emotional or spiritual one recognizes for himself the fusion and use of the whole person and the significance of the creative experience."

This latter concept of art as an objective process, a discipline rather than a fantasy, is more akin to the process referred to by Fry when he likened the artist and the scientist. The patient who learns to produce formal relationships, line, color, and perspective is learning to objectively cope with or order nature and is on the way to cope with society.

The art therapy group also provides the patients with an opportunity to participate actively in a constructive social group, an excellent setting for group therapy. I allotted several hours a week to group discussions in which the participants examined their productions, moderated by one of the group elected weekly.

The value of several of these aspects of art as therapy is illustrated in the case of a 29-year-old male schizophrenic who was admitted in a catatonic stupor, utterly unresponsive to interview. On admission, a sodium amytal interview was conducted with meager results; but while emerging from the effects of the amytal, he was provided with a set of water colors and encouraged to paint.

Figure 5 was the resulting production which he refused to discuss after completing. The following day, however, although he had been recalcitrant to all attempts at interview or conversation, he began to respond when confronted with this painting and rapport was established. The next day he produced figure 6; 2 days later, figure 7 and one week after admission, figure 8. At that time he was leading the discussion in group session and had emerged from his catatonic state, although the basic schizophrenic process was evident on interview.

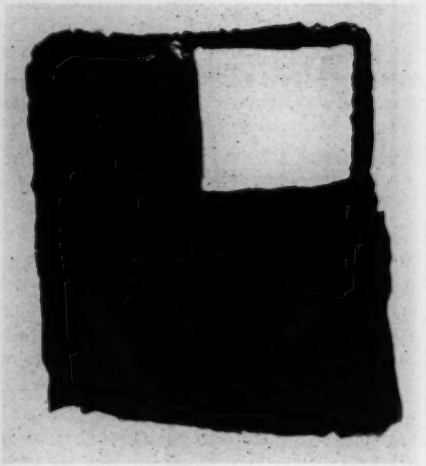

FIG. 6.

This patient's rapid emergence from the catatonic state was coincidental with his participation in art sessions; and, although it may have been spontaneous, it appeared to be accelerated by the liaison established by his first production and his participation in the group discussions. In this particular patient, art provided a means of strengthening his crumbling ego and establishing a social relationship, which at first involved the patient and therapist and then integrated the patient with the group in discussions.

COMMENT

Much of the literature on art in psychiatry has presented material culled from patients who have volunteered an interest in art. The biased selectivity of such studies, unintentional as it may be, may create an overly optimistic estimation of the value of this approach in psychiatry.

The material presented in this paper has been selected from the productions of 25

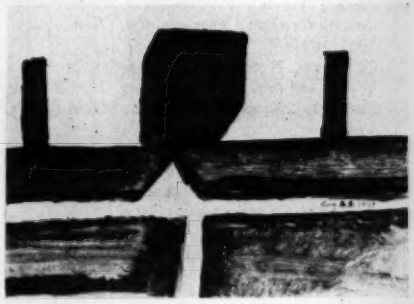

FIG. 7.

patients, the majority of whom were psychotic. These patients, almost all recent admissions, were presented with an opportunity to participate in art group therapy. Although all were cooperative in drawing the requested material, only 40 per cent expressed enough interest in the project to attend the group sessions.

Several of the patients who declined to continue in the project, produced material during the initial interview which was valuable diagnostically and prognostically. In no instance was any adverse effect noted as a consequence of the request, although the initial material at times was produced only after some exhortation.

Unfortunately, this series was too limited to allow statistical inferences as to the significance of certain features, although several provocative findings emerged. That art may be an effective category in the evaluation and treatment of psychiatric patients, needs little emphasis but an investigation of its potentialities with adequate controls and statistical inferences is long overdue.

SUMMARY

1. Art may be utilized in psychiatry as an analytic and synthetic approach toward the patient's illness.

2. The analytic function of art may facilitate diagnosis and an understanding of the dynamics of an illness. In some instances this approach may be more effective than psychoanalysis but interpretation should depend on the associations of the patient not those of the therapist. Several illustrations of this aspect of art have been presented.

3. The synthetic function of art includes its therapeutic and rehabilitative potentialities.

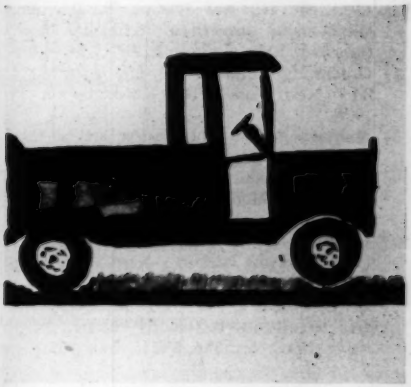

FIG. 8.

4. Art is suggested as a nucleus for group therapy.

ACKNOWLEDGMENTS

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THE PROBLEM OF LIVER FUNCTION IN SCHIZOPHRENIA

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From Hippocratic times bodily changes have been noted as accompaniments to emotion, and the intimate connection between emotions and the viscera is suggested by many phrases, attributing love to the heart and sorrow to the bowels. Descartes (8) described certain emotions of love, hate, desire and joy as being caused by the heart, the spleen, and the liver, and "not, as is the case with wonder, in the brain alone."

The liver has played a notable part in this historical association and was once—and indeed still is in popular connotation of speech—identified with feelings of depression and melancholia.

With the advent of biochemical tests, more and more interest has been taken in this brain-liver relationship, and this paper deals with the application of such a hypothetical relationship to the syndromes of schizophrenia.

For many years much attention has been given to a possible relationship between liver dysfunction and psychiatric disorders, especially schizophrenia. Many varied and sometimes contradicting results have been obtained, of which the following are samples.

Lingjaerde (19) divided his schizophrenics into acitve and passive phases, and without further classification found liver insufficiency in 80 per cent of the first group.

Jahn and Greving (14) found low bilirubin values in 21 out of 27 catatonic stupors and postulated an increased erythropoiesis and diminished red cell decomposition.

Quastel and Wales (26) found a diminished excretion of hippuric acid in catatonia, in contradistinction to other groups of schizophrenia. From this they suppose that the abnormal secretion of hippuric acid is partly responsible for the development of the psychosis. These results helped to elaborate the so-called "intoxication hypothesis" in the genesis of schizophrenia. According to this theory, some substances normally produced by bacterial action in the gut have inhibitory powers similar to narcotics in the oxidation of carbohydrates in the brain. These substances, mainly break-down products of tyrosine and tryptophan, are ordinarily detoxicated in the body, chiefly in the liver by a specific enzyme, but it is assumed that if the liver is disordered increased amounts of these unknown substances will be carried by the blood stream to the brain, where they may be assumed to have a deleterious effect.

Somewhat different results were obtained by Strom-Olsen et al. (28), who investigated a group of 62 cases of schizophrenia, of whom 28 were catatonics. Only 5 out of the 28 cases showed poor excretion of hippuric acid.

Berkenau (2) carried out investigations on 32 cases, which included depressions, schizophrenias, and some organic psychoses. He used six tests: the estimation of bilirubin in the blood, the Takata reaction, the sedimentation of blood corpuscles, the urobilin urinary test, histidine in the urine, and the conversion of benzoic acid into hippuric acid. He confirmed Quastel's work in all schizophrenic catatonics. He also found a diminution of bilirubin in 6 cases of catatonia, thus confirming the work of Jahn and Greving. The author maintains that if, in a group of psychoses, certain liver function tests have a positive result time and time again, one may be allowed to assume that the liver has a share in the etiology of these groups. He also mentions work (Damsch and Cramer) which showed children with icterus catarrhalis, with cataleptic symptoms. Berkenau's over-all conclusions were that there is a close relationship between catatonic psychoses and liver function or dysfunction.

The hippuric acid excretion test was further used by Wong (29) with positive results, showing liver dysfunction in simple deteriorated and catatonic schizophrenias.

De Jong and St. John (7), using the cephalin-cholesterol flocculation test in catatonic and other types of schizophrenia, found de-

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finite evidence of liver dysfunction as judged by this test. They reported a small series, many of which gave negative results, but they felt that this test might be of value in the differential diagnosis of certain types of catatonia. Finkelman et al. (9) likewise found 8 out of 17 catatonics with positive results; while Michael et al. (23), using the more modern intravenous technique and dosage based on body weight, found no anomalies at all.

Other positive results have been obtained by Georgi et al., (10). They again confirmed Quastel's work, using the oral hippuric acid test. Later they used a modification of their own, designed—by giving an excess of glycine with the hippuric acid—to find out whether lowered elimination of hippuric acid is due to insufficiently rapid mobilization of glycine or whether there exists a defect in the coupling mechanism. All their cases were acute schizophrenic reactions and showed deficient elimination of hippuric acid, which returned to normal when the patient recovered, either spontaneously or by treatment.

Oltman and Friedman (25) came to rather different conclusions. They reported on cephalin-flocculation tests performed on all patients admitted to a state hospital during a period of approximately one year. They found no positive results in either catatonic or non-catatonic schizophrenia, but 34.9 per cent of positive findings in chronic schizophrenic males (with 0 per cent in controls), compared to 11.8 per cent of chronic schizophrenic females (with 12 per cent in controls).

Methodologic Approach

With the above data in mind, an attempt has been made to try to correlate well recognzied clinical psychiatric syndromes with evidence of hepatic dysfunction, both from a clinical and biochemical point of view. Since the liver has so many complex and diverse functions, it was not considered fruitful to use one test or one type of observation only.

A careful clinical examination was considered essential. The history was investigated with a view to determining whether the patient had ever contracted epidemic hepatitis—a point of some significance, remembering the epidemics both in the Middle East and in the United Kingdom in 1942; chemical poisoning; worm infestation for which, for example, felix mas had been given; arsenic medication; or alcoholism. Positive biochemical results in the setting of such a history would lead to an interpretation different from that in a schizophrenic illness per se.

Special attention was paid to the physical examination, and the classical facies of liver dysfunction—the dry, sallow, icteroid skin, with watery eyes and a telangiectatic nose—was always sought. The presence of an enlarged liver and/or spleen and spider nevi on the upper part of the body were all considered significant, and a search for one or more of these signs was always made. Pigmentation and pyrexia were also sought. Even a large battery of liver function tests may be erroneous without a correlating clinical assessment. Carter and MacLagen (3) quote, among others, the following authors who found a proportion of positive results, using the serum-colloidal gold and thymol turbidity tests, in illnesses not primarily hepatic. Curphy and Solomen (4) found positive results in pneumonia. Haines, Magarth, and Powers (12) have obtained such results in hyperthyroidism. Others have obtained them in rheumatoid arthritis and glandular fever.

A battery of liver tests was performed and, following Kelsall et al. (16), a combination of plasma-bilirubin, alkaline phosphates and protein estimations was considered as reliable and informative as any other. In addition, MacLagen's (20) thymol turbidity test was used, the normal being 0-4 units and Ehrlich's aldehyde reaction for urobilin and urobilinogen in urine was also performed. Serum bilirubin was estimated according to the method of King et al. (18), and the normal value was considered to be less than .8 mg/100 mls. Serum phosphatase was estimated by the method of King (17) and the normal value was believed to be between 4 and 15 units per 100 mls. of blood. Serum albumin and globulin were also estimated by the method of King and the values taken as normal were, in the case of albumin between 4 and 5.7 G/100 mls. of blood, and in the case of globulin between 1.5 and 3 G/100 mls.

Material

Seventy-six cases of schizophrenia were

TABLE I

	Plasma Bilirubin	*Plasma Phosphatase*	*Serum Albumin*	*Serum Globulin*	*Thymol Turbidity*
Mean of 76 cases	0.56 Mg/100 mls.	5.6 Units	4.72 G/100 ml.	2.6 G/100 ml.	1 unit

studied. Of this number, there were 25 cases of the paranoid type, 10 cases of the simple, 15 of the hebephrenic, and 26 who fell into the category of catatonia. Of the 26 catatonic cases, 5 could be termed periodic, the rest progressive. The duration of their illnesses lasted from eight weeks to 18 years. Their ages lay between 17 and 51 years.

Careful consideration was given to the problem of diagnosis, especially in the case of the catatonics. Kraepelins' standard definition was closely followed, and only those cases showing a conjunction of excitement with stupor were so diagnosed. Patients were chosen as far as possible, when their diagnoses were obvious. Any doubtful case, for example a patient showing the features of a schizo-affective disorder, was excluded, and it is contended that the above cases can be reasonably considered typical from a diagnostic point of view.

A great advantage was gained in being able to follow 7 of the catatonic patients through the various phases of their illnesses by serial clinical and biochemical estimations.

Lastly a control series (9 patients) of cases with known liver dysfunction was made, using the same technique as for the routine tests.

Results

The results so obtained may, therefore, be seen under three headings, namely:

1. The results of investigations of liver function in 76 patients showing variations of a schizophrenic illness;

2. Serial clinical and biochemical findings in 7 catatonic patients;

3. The results obtained in 9 known cases of liver disease.

The first part of the investigation was mainly negative clinically and biochemically. A scrutiny of the patients' history and a physical examination showed no evidence in any of these cases of any hepatic dysfunction. The biochemical results can be expressed as follows. No urobilinogen was discovered in any of the cases.

Six patients showed values of bilirubin above the maximal normal value of 0.8 mg/100 mls. as used in this work, but these were sporadic and only slightly increased; for example, the maximum was 1.2 mg/100 mls; was not found with any other biochemical anomaly and was almost certainly due to experimental errors. Similarly, three anomalous results in the level of the plasma phosphatase were only slightly deviated from the normal and could again be regarded in this light. Five cases showed a slight increase of serum albumin and four others an increase of serum globulin. In none was the albumin/globulin ratio altered and in none were other biochemical anomalies found.

The second part of the investigation, i.e., the serial results correlated clinically, can be seen in the following table. The 7 cases of catatonia were also considered from the "once only investigation," as given above. Two of the cases were periodic; the other five must be considered progressive, in the sense that phasic variations to normality did not occur.

The third aspect of the investigation concerned itself with 9 controls. These were investigated by the same procedures, both clinically and biochemically. All showed unequivocal evidence of clinical hepatic dysfunction. The results may be seen from Table III.

Discussion

Although, as has been shown, investigations on liver function in schizophrenia have been carried out and published, the position is still quite unclarified, and many authors have urged more investigations in this direction. Mayer-Gross (22), discussing experimental psychoses produced by drugs, emphasizes once again the importance of hepatic function for a study of the etiology of psychiatric diseases. He observes that investigations by Jantz (15) on mescaline intoxication seemed to point in the same direction and the latter's findings sug-

TABLE II

	Sex and Age	Urobilin in Urine	Plasma Bilirubin Mg / 100 mls	Plasma Phosphatase Units	Serum Albumin G / 100 mls	Serum Globulin G / 100 mls	Thymol Turbidity. Units	Clinical State and Examination
	M. 34	Nil	0.50	3	4.05	2.82	3	State of stupor
		Nil	0.45	4	4.23	2.75	2	4 weeks later, after ECT, sensorium clear, but unequivocal evidence of schizophrenia
1.		Nil	0.44	3	4.65	2.69	1	10 weeks after last record, when patient again lapsed into stupor, with intermittent attacks of excitement
	M. 18	Nil	0.73	4.7	3.82	1.46	3	Extreme excitement with auditory hallucinations
		Nil	0.56	6.2	4.20	2.70	1	5 weeks later, in state of stupor
2.		Nil	0.49	5	3.90	2.80	1	3 months after last recording; no appreciable change in spite of ECT and coma inslin
	M. 42	Nil	0.47	4.7	3.82	1.46	3	Extreme excitement
		Nil	0.50	6	4.02	2.90	2	State of stupor coming on spontaneously, 3 weeks after initial readings
3.		Nil	0.56	5	4.80	2.82	3	2 months later, when well, after spontaneous recovery
	M. 28	Nil	0.70	9.5	3.97	2.10	3	Extreme excitement; grossly hallucinated
		Nil	0.52	6	3.70	2.30	2	5 weeks later when excited state had terminated; mute unresponsive, and negativistic
4.		Nil	0.67	8	3.50	2.68	2	3 months later, when illness apparently resolved with ECT
	F. 18	Nil	0.50	5.5	3.90	2.19	2	State of stupor
		Nil	0.62	5	3.89	2.80	1	5 weeks later, after a course of ECT; apparently well
5.		Nil	0.67	8	3.50	2.68	2	3 months later; another onset of stupor, with periods of restlessness and excitement
		Nil	0.49	6.2	3.20	2.20	1	9 months after last reading; again in stupor

TABLE II.—Cont'd.

	Sex and Age	*Urobilin in Urine*	*Plasma Bilirubin Mg / 100 mls*	*Plasma Phosphatase Units*	*Serum Albumin G / 100 mls*	*Serum Globulin G / 100 mls*	*Thymol Turbidity. Units*	*Clinical State and Examination*
6.	F. 24	Nil	0.46	5.1	4.8	3.2	3	State of stupor
		Nil	0.42	4.2	5.10	3.46	2	3 months later; hyperactive, impulsive, unpredictable
		Nil	0.3	4.3	4.60	3.12	2	6 months later; similar excited state
		Nil	0.56	4.2	4.42	3.40	2	12 months later; stupor
		Nil	0.64	3.0	4.42	3.10	3	16 months after first seen, excited, noisy, hyperactive
7.	F. 19	Nil	0.59	6.1	4.20	3.51	1	State of stupor
			0.52	8.9	4.55	3.64	1	6 months later; partial stupor, mute, negativistic
			0.60	3.9	5.04	2.66	3	1 year after first seen

TABLE III

Sex and Age	*Urobilin in Urine*	*Plasma Bilirubin Mg / 100 mls*	*Plasma Phosphatase Units*	*Serum Albumin G / 100 mls*	*Serum Globulin G / 100 mls*	*Thymol Turbidity Units*	*Clinical State and Examination*
M. 46	−	1.50	9.4	3.84	4.56	6	Abdominal ascites, icteroid facies, liver enlarged 2½ fingers, nobbly; some edema of ankles
M. 38	+	10.20	23.1	3.57	3.16	3	Typical case, infective hepatitis; liver enlarged 3 fingers; stools clay-colored
F. 38	+	1.41	17.4	3.56	3.20	2	Typical case but rather mild clinically of infective hepatitis; liver enlarged 1½ fingers; stools clay-colored
M. 48	−	1.80	15.4	3.21	3.22	5	Liver enlarged 3 fingers; irregular with 'knobs'; periodic abdominal ascites; has had two bouts of hematemesis
M. 52	−	.76	9.6	2.96	3.80	4	Long-standing case of cirrhosis, with liver enlargement and ascites
M. 28	+	37.00	14.7	4.05	3.00	7	Early case of typical infective hepatitis, subsequently running a classical course to recovery

Sex and Age	Urobilin in Urine	Plasma Bilirubin Mg / 100 mls	Plasma Phosphatase Units	Serum Albumin G / 100 mls	Serum Globulin G / 100 mls	Thymol Turbidity. Units	Clinical State and Examination
F. 32	—	2.50	8.0	3.20	3.20	3	Splenomegaly and hepatomegaly; possibly early Banti syndrome
M. 43	—	2.80	7.0	2.92	3.60	4	Hepatomegaly, 3 fingers; periodic ascites; clinically cirrhosis
M. 26	+	12.20	9.0	3.62	2.90	5	Early infective hepatitis

gested capillary damage by the drug. Through the walls of the damaged capillaries, protein leaves the blood, entering the liver tissue where it is stored and pathologic studies revealed damage to this organ.

The present work has been an attempt to apply a combined clinical and biochemical assessment to the problem. This approach appears to be essential in any study of liver function, even in the presumed marginal dysfunctions. Informed opinion is in agreement with this conception, and, for example, Himsworth (13) believes that there is no test which approaches in value a careful clinical assessment of the patient.

The selection of a particular liver function test is of considerable importance, and here reliance must be placed upon workers who have had great experience in this field.

There is no doubt of the tremendous reserve of the liver and its extraordinary ability to regenerate after injury. It is probably impossible to demonstrate fine hepatic lesions by biochemical changes, since Mann (21) has shown that four-fifths of an animal's liver can be removed without causing any symptoms other than initial shock. Moreover, few attempts have been made to view liver function as a dynamic process, by repeating the tests at intervals, especially in the different phases of catatonia. Of great importance is the use of a battery of tests, each designed to test a separate function. Many authors have criticized the hippuric and excretion test, among them Sherlock (27) who pointed out that although there is some impairment of hippuric acid excretion in liver disease, this impairment cannot be correlated with, nor is it proportional to, liver damage as estimated by puncture biopsy. Again, this test should always be accompanied by a test of renal function for, as Sherlock has shown, efficient liver functioning would be masked if there were any degree of kidney failure. Other objections to this test are that the estimated synthesis seldom falls below 45 per cent of normal, presumably due to extrahepatic synthesis, but a similar result would be given by the excretion of unchanged sodium benzoate by the kidneys (Moser et al).

Gray (11) has shown that the proportion of sodium benzoate excreted unchanged may depend upon the rate of injection and, since unchanged benzoate would be estimated as hippurate by ordinary methods, its excretion would seriously limit the usefulness of the intravenous sodium benzoate test in assessing hepatic function. This author further considers that the results of all tests of liver function vary according to the severity and stage of the liver disease.

The battery of tests suggested by Kelsall et al. (16) was used in the biochemical inquiry, and in addition MacLagen's thymol turbidity test. Kelsall et al. believed that these three tests "will give as much information as can be obtained from more elaborate tests." All the tests have proved clinical value and in combination are, it is felt, more reliable in a discovery of hepatic dysfunction than any other group or single test. Puncture biopsy would seem to be par excellence the method of investigation, but the procedure is not without both danger and limitations; danger in the form of hemorrhage, and limitation in the

shape of the small specimen being unrepresentative. Sherlock has performed aspiration biopsy on 187 patients with liver disease, and tried to correlate the histologic appearance with biochemical tests. She found that hippuric acid, synthesis, for example, was inconstant and did not agree with the extent of the lesion, but that a fair degree of hepatic damage was reflected in the serum bilirubin and serum albumin levels. She also noted that in histologically inactive cirrhosis no constant biochemical abnormalities were detected, hence another cogent argument for careful clinical examination.

Again, it has often been suggested that serial tests are of much greater value than single observations (Daley and Miller; Berk and Shay). This appears a very reasonable proposition, when it is remembered that the liver is often seen to be performing satisfactorily when only a small proportion of its cells remain undamaged and that liver function per se must of necessity be considered a dynamic process. It is felt that the 7 cases of catatonia so followed, although numerically few, fulfill the criterion comparatively well.

In the author's view, the results of the above work do not suggest any liver involvement in the various symptom-complexes of schizophrenia. Modern liver function tests can be fallacious, especially when used singly, but it would seem reasonable that, used as a battery and combined with a clinical evaluation, some positive results of significance would have been found had there been any pathophysiologic hepatic changes. Such findings do not, of course, preclude positive results by more sensitive tests, hitherto not available. At the present time, however, it is suggested that a combined clinical and biochemical approach is the best method at our disposal for evaluating liver function.

Conclusions

1. An investigation into hepatic function was made on 76 schizophrenic patients, and serial clinical and biochemical investigations were made on 7 catatonic schizophrenics.

2. Whatever the age of the patient, the duration of the illness, or the clinical type of the disorder, both clinical and biochemical findings were, in the main, consistently negative.

3. The same biochemical tests, when applied to 9 known cases of hepatic disease, gave consistent and well defined positive results.

4. Serial biochemical tests applied to various clinical phases of 7 cases of catatonic schizophrenia were likewise uniformly negative and at no phase of the illness suggested underlying liver disorder.

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PSYCHOSOMATIC STUDY OF A CASE OF PALINDROMIC RHEUMATISM[1]

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Palindromic rheumatism, thought to be a rare type of arthritis, has received little attention in the literature. It is the purpose of this paper to describe the psychodynamic formulation found in a patient with this illness and to compare this formulation with those found in patients with other types of arthritis.

Hench and Rosenberg (1) first described palindromic rheumatism. They reported it as an oft-recurrent disease of joints and adjacent tissue. Outstanding among their clinical findings were multiple afebrile attacks of acute arthritis and periarthritis and sometimes also para-arthritis, with pain, swelling, redness, and varying degrees of disability, generally of only one joint but sometimes of more than one. The knees, elbows, fingers, wrists and shoulders, were the joints most frequently afflicted. The attacks appeared suddenly, developing rapidly over a period of a few hours or days and then disappeared completely, only to reappear at intervals varying from a few days to a month or longer. Laboratory tests revealed little or no constitutional functional abnormality; roentgenographic studies showed no significant functional pathological residue even after years of disease and scores of attacks. Description of the illness by others are nearly identical to the picture described by Hench and Rosenberg.

A few reports have hinted at psychological complications in this illness. Paul and Carr (5) reported the illness in a 51-year-old patient who had a lifelong history of "poor adjustment". In addition, he was alcoholic presumably because of "nervous trouble". They suggested a possible "psychosomatic basis" for the palindromic rheumatism. Paul and Logan (6) reported the case of a 49-year-old woman exhibiting all the signs and symptoms of palindromic rheumatism, whose attacks were generally precipitated by "anger and nervousness". Zentner (9) described a case of palindromic rheumatism in a 46-year-old married laborer with fairly definite psychosomatic factors. The psychodynamic formulation found in this case appears to be very similar to the one found in the case to be described here.

As can be seen from the review of the literature, psychosomatic aspects of this disease have been only suggested, with the exception of Zentner's case which points more definitely to psychological factors. His was the only case reported subjected to thorough psychological study. An opportunity for such study was afforded by the case to be presented. Conflict over repressed hostile and aggressive impulses and dependency needs was found to be closely related to the attacks of palindromic rheumatism in this case.

Case Presentation

The patient, a 39-year-old, single coal miner, was admitted to the Psychosomatic Service of Winter VA Hospital with complaints of recurrent painful swelling and redness of his elbows, as well as nervousness, insomnia, and irritability. He appeared to the examiner as a stocky, muscular man who sat rigidly on the edge of his chair, avoiding the examiner's eyes. His rheumatic symptoms began two years prior to admission with involvement of the elbow joints. He had two or three attacks a week, each lasting one to three days and relieved by heat and rest. At first only the elbows were involved, but eventually his knees and occasionally his shoulder joints also became involved. The symptoms never occurred in more than one joint at the same time.

The patient was born the seventh of nine siblings of a strict domineering father and a meek but very religious mother of rigid moral beliefs, toward whom the patient felt closer than to anyone else. Competing with his brothers and father, who placed a high value on physical fitness and strength, he went to work in the coal mines at the age of 12. His interests were in his work and solitary pursuits such as hunting and raising hounds. He dated occasionally, but had no close relationships with girls. He described himself as having been a timid, obsequious person who never fought, went to church each

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Sunday, and did most of the chores around the house.

He remained at home, working in the mines until the age of 29 when he enlisted in the infantry because "in that branch a man could really fight and serve his country; you have to be a man to stay in that outfit." The three years in the service were spent mainly in combat as a machine gunner, where he was much respected by his buddies and officers because of his prowess in killing the enemy. While in the service, he developed a close attachment to two other servicemen and his captain toward whom he felt dependent for protection. He witnessed the death of each of them and felt lonely and lost without them.

Following discharge from the service, he came back to live with and care for his invalid mother. Upon returning to his job in the mines, he found himself afraid of and anxious about people as well as his work. He began drinking excessively in an attempt to gain relief from his feelings of fear and apprehension, and when drinking he would become involved in fights and would have the urge to kill. Since alcohol was never allowed in his parent's home, he was severely criticized by all members of his family.

The patient's rheumatic attacks began about two years prior to admission. During an attack he was unable to work; therefore his earnings were reduced to subsistence level.

The physical examination was within normal limits. Laboratory studies including x-rays of the joints, blood count, sedimentation rate and uric acid were all within normal limits.

Following a thorough medical work-up, the diagnosis of palindromic rheumatism was established on the basis of the history of recurrent attacks of afebrile acute arthritis with pain, redness, swelling, and disability of one joint at a time.

The patient was placed in psychotherapy, and was seen two hours a week for six months. For purposes of discussion, development in psychotherapy will be presented in terms of three phases.

During the first phase, which lasted about one month, the patient was preoccupied with complaints of muscalar stiffness and soreness. Despite his complaints, which implied criticism of the therapist, he was extremely meek and docile toward the therapist, keeping his head bowed and avoiding looking directly at him. He resisted all attempts of the therapist to discuss his feelings, attributing any improvement in his rheumatic symptoms to the pills (salicylates) and physiotherapy. Although he denied any benefit from psychotherapy, he continued to come to the office willingly for the sessions, stating that even though they were doing him no good, he might eventually be able to get some benefit from them.

The second phase was marked by increasing dependency upon the therapist. He began making excessive demands for sedation, for more of the therapist's time, for additional privileges and favors. He abreacted his battle experiences at great length, flailing his arms about and shouting. He described with ferocious intensity how he had killed and hated the enemy. He wondered how he was able to do such evil things. "In the Bible it says, 'Thou shalt not kill,' but over there we were taught how to kill and made to kill. I killed hundreds of them but I was drunk the whole time. I never went into battle sober." In relating his battle experiences he would become quite upset and tremorous. At the time he was displaying this violent behavior during the psychotherapy sessions, on the ward he remained his meek, Casper Milquetoast self, the butt of all the ward jokes. During abreaction, he was able to express more directly his feelings of dependency upon the therapist and consequent feelings of hostility. On one occasion, when the therapist would not grant one of his demands, he became intoxicated and was transferred to a locked ward for the night. The patient felt very guilty about his behavior, but at the same time was able to criticize the therapist directly for the first time, mildly reproaching him for denying his demand. The day after this session, he had a rheumatic attack involving his right elbow lasting one day. This attack consisted of swelling, redness, and stiffness of the right elbow joint. The joint was painful upon movement. Patient was afebrile and the laboratory tests were within normal limits. Two days later there was no objective or subjective evidence of disability in the joint. This is the only rheumatic attack he had since beginning psychotherapy.

During the third phase, the patient was able to express much more directly his hostile feelings toward the therapist, which were intensified by the therapist's denial of his unrealistic demands. These demands consisted of such requests as passes to leave the hospital, change of the hour to an evening hour, special diet, etc. His hostile feelings continued to become more apparent. "When you came on the ward, I felt like jumping you; if I had, I think that I would have killed you, I was mad enough." At this point in therapy, two appointments were cancelled because of the Christmas holiday. At the next session, the patient angrily accused the therapist of letting him down. "When I was overseas, I didn't stop fighting because it was Christmas. I wouldn't have let you down just because it was Christmas."

That evening the patient was in a state of acute psychotic agitation. He claimed that he was the Diety and the therapist was the Devil. He accused the therapist of causing him to sin and making a killer out of him. During the psychotic episode, the patient had no arthritic symptoms or complaints, whereas up until that time he had complained continuously of aches and pains. This episode lasted only a few days, and following this, the patient discussed his battle experiences in a much more controlled manner. He felt less anxious and he had no tremor. He became more friendly with the other patients, participated more actively in social activities and occupational therapy.

Formulation

Here is a man who had related himself to

the world through his muscular skeletal system. Violent physical activity was his only means of competition and aggression, as well as of denying his very strong dependency needs. During the war, his repressed murderous impulses found sudden and violent release in orgies of killing. When after the orgy he had again to control his murderous impulses, he found that the previous mode of defense through displacement was no longer effective. These murderous impulses, having once found direct expression, kept coming into consciousness and could no longer be repressed or displaced in strenuous muscular activity.

It seems possible that this would result in muscular tensions being set up which, if allowed full expression, would result in murderous activities. Instead, some state of tension in muscle groups occur and these impulses are inhibited through tension in antagonistic muscle groups. The net effect might be joint pain, fixation of the joint, and the physiological chain of events that we see as palindromic rheumatism. Thus hostile impulses that otherwise can come out when drunk, are now channeled so they can be constantly expressed physiologically in the rheumatism. The illness, once established, becomes a means of self-punishment for his guilt feelings since it renders him unable to work—which has been his main source of prestige and self-esteem. With the palindromic rheumatism, he is able to satisfy his dependency needs through the attention of doctors, nurses, et cetera.

Discussion

As early as 1909, Lewlyn Jones (3) pointed out that psychic shock might precipitate attacks of arthritis. A number of authors have described the general psychosomatic aspects of arthritics as well as those in specific types of arthritis. Weiss (8) in a study of 40 patients referred to him because of various complaints referable to the neuromuscular system, found that "the specific psychiatric feature in all was chronic resentment of which the patients were unaware." He pointed out that "tension is best relieved by action, but when action is inhibited, tension is likely to be felt as pain or limitation of motion." Johnson, Shapiro, and Alexander (2) made an intensive study of the psychodynamics found in patients with rheumatoid arthritis. Their male patients showed "a chronic state of inhibited rebellious hostility. This seems to be a reaction against unconscious dependent feminine trends for which they overcompensate with aggressiveness."

What has here been described as the conflicts and psychological configuration of defenses of a patient with palindromic rheumatism seems equally applicable to the patients with rheumatoid arthritis. The psychological conflicts appear to be the same but the diseases are different; therefore, the dynamics in themselves do not seem to give the key to the type of arthritis that develops.

Lihn, Menninger, and Mayman (4) studied 20 cases of osteoarthritis in order to determine the characteristic personality factors that distinguish osteoarthritis from rheumatoid arthritis. They noted that many of the patients were born in large families of low cultural and economic level. All of these patients "were in varying degrees ignored, neglected or rejected by their overburdened or inconsiderate parents." In later life, they showed markedly aggressive behavior in such forms as competitive sports, quick temperedness, rage reactions, personal combativeness, impulsive outbursts, and erupting hostilities. Their interpersonal relationships were superficial and unstable. The authors conclude that "a precarious balance of aggression and dependency is established in these patients, and when this balance is upset, the joints assume the burden of compromise." These personality factors bear striking resemblance to both rheumatoid arthritis as well as palindromic rheumatism.

In comparing the psychodynamics of patients with osteoarthritis as seen by Lihn, Menninger, Mayman (4) with those worked out on patients with rheumatoid arthritis as seen by Johnson, Shapiro, and Alexander (2), and our patient many similarities are observed. The patients.

(1) Place great emphasis upon muscular achievements.
(2) Relate to the world primarily through the neuromuscular system.
(3) Show aggressiveness in such forms as sports and laboring jobs.
(4) Have superficial and unstable interpersonal relationships.
(5) Have chronic resentment.

(6) Have unconscious dependent feminine trends.

(7) Have inhibited aggressive and murderous impulses.

In spite of the similarities listed above, our patient showed striking differences from other types of arthritis which are worthy of note.

(1) Palindromic rheumatism is a more benign type of arthritis.

(2) A more severe type of psychological disorganization was seen in this patient than seem to be characteristic of most patients with rheumatoid and osteoarthritis, also a weakness of ego to a point of psychotic reactions.

(3) With his apparently greater need to deny more strongly unacceptable dependent wishes, he does develop an illness which is a milder one and does not lead to the same crippling as the others. In this way his overcompensatory functioning through muscular work was able to continue indefinitely. Also these dependent needs could be channeled if need be by grossly psychotic behavior.

The speculation may be made that the above-listed dissimilarities may help explain why this patient developed palindromic rheumatism rather than some other type of arthritis. It would be interesting if in other patients with palindromic rheumatism we would find the same differences and similarities.

Summary

1. The case of a patient with palindromic rheumatism is reported with a review of the literature on palindromic rheumatism.

2. Treatment of this patient and results of therapy are described, and a psychodynamic formulation of the patient's illness has been presented.

3. The psychodynamic explanations of findings in this patient were compared with those dynamic explanations in patients with rheumatoid and hypertrophic arthritis. The similarities and differences were noted and a possible explanation offered as to why this patient developed palindromic rheumatism rather than one of the other types of arthritis.

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GESTALT PSYCHOLOGY AS APPLIED TO LANGUAGE DISTURBANCES

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The idea that specific and basic dysfunctions are at the root of a variety of language disturbances grew out of our experience at the Language Disorder Clinic at the Columbia-Presbyterian Medical Center in New York, where we found that we were able to predict a large percentage of future dyslexias among the three, four and five-year olds who had originally been referred because of speech delay or severe dyslalia.

Time and again we were confronted with the same clinical picture: a succession of bright youngsters who had been late in starting to talk and who at the age of five were practically unintelligible, whose motor speech patterns were extremely poor, whose grammar was deficient, who omitted parts of words, condensed and reversed sequences of sounds. On closer observation we found that these children were clumsy in finer muscular coordination, that their auditory memory span was inferior, that they were hyperactive and somewhat uncontrolled. The very same youngsters were later brought back to us at the age of 9 or 10 because of failure to catch on to reading. They still were hyperkinetic, their auditory memory span still were under par, they were still awkward when it came to finer muscular control. In their attempts to read, they reversed sequences of sounds, condensed and omitted parts of words in exactly the same way they used to reverse and condense auditory symbols earlier.

At first we assumed that difficulty with the printed word was the direct result of these children's inadequate language background, that their inability to discriminate between sounds heard accounted for their difficulty with discrimination of letters seen. This assumption, however, when further tested, proved to be valid for only a limited number of cases. The large majority of our dyslexic children had actually acquired a good oral language background, their motor speech patterns had become thoroughly acceptable by the time they were exposed to printed material. The question then was: Why do a large number of formerly speech-delayed and dyslalic youngsters run into trouble when they are confronted with reading?

Orton (11) was the first who maintained that there is a close relationship between all aspects of language function in children, that the difficulties with oral speech as manifested by the speech-delayed and dyslalic youngster and the trouble with printed language as shown by the dyslexic one are symptoms only of a generalized language disability. Borel-Maisonny (3) in her excellent contributions has emphasized receptive and expressive oral deficiencies in dyslexic youngsters. Weiss (16) has recently confirmed this hypothesis when he speaks of "central language imbalance."

Starting out then from the hypothesis of such a generalized disability we asked ourselves what does "central language imbalance" actually mean? What does it involve? We believe that a closer investigation into the perceptual, motor and emotional status of children suffering from severe language dysfunctions may shed some additional light on this question.

All our youngsters at the clinic—and for the purpose of this discussion I limit myself to those of at least average intelligence—are routinely subjected to extensive psychological examination. As a result we have found over the years that a large number of them shows a distinct pattern of performance on a given series of tests. Our children sometimes rate up to twenty or thirty points higher on the performance than they do on the verbal part of a scale like the Bellevue Wechsler. Not only is their vocabulary and their information more limited than that of the control group (which could have been expected) but their ability to form abstract concepts is decidely inferior. If tested for instance for similarities and opposites these children do poorly when compared with other youngsters of the same age. It is of interest

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that they perform poorly in coding as well—a task which is generally assumed to belong to what is called concrete performance. Coding, however, requires handling of symbols and it seems that in these children all types of symbols, not only verbal ones, present difficulties. Goldstein's (5) work on disturbances of symbolic behavior in the brain-injured individual is of interest in this context. Again, as a rule, these children score below expectation in finer muscular coordination. Bender and Yarnell (1) have commented on motility disturbances in children suffering from language disabilities, and Orton (12) is undoubtedly right when he says that we frequently find dyspraxic individuals—among them those with severe difficulties in penmanship—in the speech defective and dyslexic group. Osseretsky's (13) investigations point in the same direction.

Another characteristic of our particular group is confusion in motor leads. Establishing a functional superiority of one side over the other is, of course, also a matter of maturation and is seldon firmly achieved before the ages of three or four. However, our youngsters do not generally show a clear cut superiority till much later and in the dyslexic group, which ranges from seven years upward, we find ample evidence of crossed laterality, residual ambidexterity and difficulty with establishing left-to-right progression, the specific directional discipline essential to reading in our culture.

There are other areas in which our children deviate:

The Bender-Gestalt test (2), which evaluates visuo-motor functioning, reveals a striking immaturity of Gestalt functioning in dyslexic youngsters. This has been demonstrated in a study made on fifty cases at Bellevue Hospital in New York City. Our own investigations confirm these observations for dyslalic and speech-delayed children. Their motor-Gestalten also are extremely primitive. Not only do they show a tendency to verticalization, a typical phenomenon in chronologically younger children, but they also have great difficulties when asked to copy interlocking figures. They seem to have trouble synthesizing configurations and show what Goldstein (6) calls "concreteness in motor performance". Their ability to experience Gestalten in terms of spatial and temporal relationships is undoubtedly under par.

The Goodenough (7) test is well known as a measure for evaluating intelligence. Galiferet-Granjou (4) uses it for grading ability to organize spatial relationships and finds that dyslexic children, are on the average, two years and seven months retarded when compared with a control group. We use this test in our speech-defective group not only for determining hand-eye coordination, capacity to handle three-dimensional space and manual dexterity but above all to evaluate maturity of body image, a concept which refers to the image of self derived from parts of the body and their relationships to each other. This body image seems to be consistently primitive in children suffering from severe language deficiencies.

There are a number of interesting studies showing that brain injury, and in fact any lowering of integrative efficiency, brings about an impairment in figure-background relationships (18). Such figure-ground disturbances are now considered among the diagnostic features in the brain-injured child who does not necessarily present any gross neurological symptoms. These figure-ground disturbances have not yet been systematically explored in children who suffer from language dysfunctions. Our own findings, though limited in scope, show the same tendency if to a lesser degree. Time and again our children fail to find the relevant figure if shown a pattern melting into the background. In many instances they make a poor showing on the Marble Board test because of their incoherent and fragmentary approach and because of their abnormal preoccupation with the background which interferes with the figure.

While little work has been done in the investigation of visuo-motor and preceptuo-motor disturbances in our children, many observers have commented on their hyperactivity and their lack of control. Interpretation frequently has been along psychiatric lines. The psychiatrist says that the difficulty in the language area and the hypermotility of these youngsters are both symptoms of a psychological disorder. The speech therapist, on the other hand, insists that these children are hyperactive because they lack the tools for effective expression and communication. Both interpretations are undoubtedly correct in a number of cases. In reviewing a large number of family histories taken over

a period of years, however, we find reports of early hyperkinesis and disorganization in children under eighteen months, long before speech could have developed. As a matter of fact, some of the mothers offer the comment that their children have been unusually active even in utero. Many of them show no indication of psychopathology, but their drivenness, their difficulty with inhibition of motor and emotional responses, seems to fit in with the rest of their behavior.

To sum up: The emotional, the perceptual and motor performance of our speech-delayed, dyslalic and dyslexic youngsters seems to fall into a distinct pattern. They apparently have trouble at every level of integration. They appear—and this is our hypothesis—to have difficulty with structuralization and organization of Gestalten. We feel in other words that it is Gestalt Psychology as originally conceived by Wertheimer which will throw light on some of our most baffling language dysfunctions. As formulated by Wertheimer (19), Gestalt function is defined as that function of the organism which responds to a given constellation of stimuli as to a whole, as to a figure, to a sequence of musical tones, for instance, to a tune (even if it is transposed into another key), to a constellation of pencil strokes as to a square (even if it is presented at a different angle). Our contention is that the ability to experience and to respond in terms of Gestalten is one of the basic conditions in the successful handling of language phenomena.

Gestalt psychology (8) says that any form is characterized by being separated, by standing out in relief. The word-deaf child undoubtedly perceives sequences of sounds but the figure is not sharply differentiated from the background; he responds to speech as if it were noise, he responds to the background rather than the foreground.

Form (9), according to Wertheimer, depends on the relationships between the whole and its parts which mutually determine each other. Speech is not a succession of separate units. We believe that the dyslalic child perceives sequences of sounds in a relatively unstructured way. Interpretation of organized language depends not on single sounds but on their relationship to each other. It is likely that the dyslalic youngster misses out in the organization of these relationships. Without the ability to retain and evoke well-organized auditory patterns, motor speech is bound to be defective—since we agree with Kohler (10), who maintains that the sensory and motor should be thought of not as two different systems connected by communicating pathways, but rather as two parts of a comprehensive mechanism. No wonder, then, that the dyslalic child's own speech—representing in itself a definite constellation, a motor-Gestalt—is defective. His tendency to reverse sounds, to condense words, to omit syllables, reflects his difficulty with recognition and production of sharp configurations which are clearly organized in terms of parts and whole. The very monotony of dyslalic speech—Weiss (17) has commented on the same phenomenon in the cluttering youngster—is symptomatic of the fact that he lacks insight into significant relationships, both phonetically and grammatically, since grammar is an expression of structure. The dyslalic child's words, like those of the clutterer, run together. His sentences are poorly organized; the figure does not stand out clearly in relief.

The dyslexic child does perceive printed letters, but his recognition of separate units will not in itself result in meaningful interpretation. The total form quality, according to Wertheimer, determines the quality of the separate units. A sentence read is more than a series of letters; it represents a scheme of organization, a scheme which has to be experienced as a totality and which has to be fitted into a meaningful context. Orton (11) has found that the child suffering from language disabilities has trouble with the orderly recall of sequences—with temporal ones in the case of the dyslalic, with spatial ones in the case of the dyslexic and with sequences of movements in the case of the dyspraxic youngster. It seems to us, however, that this difficulty with picturing and building of sequences of sound and letter units is only part of the child's inability to recognize and reproduce the dimensional and organizational details of perception which determine the structural coherence of the Gestalt. Viewed in this light, much of our children's behavior, above all their inferior performance on the Marble Board and the Bender Gestalt, takes on added significance. Why do our youngsters so often have trouble with form,

size and space? Why do they so often show tactile defects? Why do they do poorly in digit repetition and in the imitation of tapped-out sequences? Fundamentally because in the recognition and reproduction of such patterns they have to pick out a configuration, have to reject certain stimuli so as to be able to attend to the figure. Not only must the constellation be sharply delineated against the background, but the spoken sentence, exactly as the tapped-out pattern must be clearly organized in terms of temporal relationships. We agree with Stamback (15) who says that rhythmic disturabnces of dyslexic children are really deficiencies in temporal structuralization. It should be added that in the organization of perceptual configurations certain analytical and synthetical processes are involved. Goldstein maintains that for successful performance "the abstract attitude" is already required on the perceptual level. The perceptual and the symbolic processes cannot be actually separated from each other and in this light our children's poor abstract performance —on both the verbal and non-verbal levels—is of particular interest.

Finer motor coordination also requires patterning. Movement, exactly as is the case with perception, has to be experienced as an entity. A summation of small units will never result in smooth, fluid performance. One cannot compare the successive beats of a metronome, in which one stroke follows another, with living rhythm underlying acts like speaking and writing. The most careful execution of single movements will not produce a flowing hand. A succession of correct sounds will not result in speech. All of us have been in despair over the severely dyslalic child whose speech output is jerky and staccato in spite of the fact that he has mastered all individual sounds.

Our children's difficulty with patterning, however, appears not only in their perceptual and motor performance but also in integration and organization of behavior. Their trouble with inhibiting and channelling of impulses seems to be but another aspect of their inability to organize the endless stream of stimuli into behavioral configurations. The result is hyperkinesis and lack of control. In this framework, we cannot thoroughly discuss the question whether or not our youngsters' relatively primitive Gestalt organization is to be considered in terms of a physiological variant or whether it indicates a developmental lag. Studies done at the Bellevue Hospital, where Silver (14) investigated the postural reflexes, tonus and motility of fifty severely dyslexic children, point to maturational delay. The encephalograms of these youngsters reveal dysrhythmia, slow waves indicating immaturity rather than pathology.

The studies done by Zazzo (20) and his collaborators in Paris also stress developmental lag in terms of temporal and spatial organization. Our own clinical observation of children suffering from severe language disability confirm, the impression of an overall delay in maturation. Further studies would have to investigate whether Silver's findings hold true also for severely dyslalic and word-deaf youngsters.

It would be of interest from the speech therapist's point of view to evaluate our therapeutic successes and failures in these terms. We should try to find out whether those of our youngsters who respond to speech therapy show simultaneous signs of maturation in their perceptual and motor Gestalten, a maturation going beyond that generally expected in normal development. Is it possible that we sometimes succeed dramatically with our cases because our techniques—the cutting down of the flow of speech into shorter and less complex configurations—enable the youngster to acquire some sort of mastery? Are we not more effective, on the other hand, when we practice short phrases —closed figures in other words—rather than isolated units, single sounds? Does verbal training facilitate Gestalt organization in other areas or would our children actually do better if first helped with patterning of motor, perceptual and behavioral responses before being exposed to speech work proper? We will need much patient observation before we even begin to answer any of these questions.

Summary

Clinical observation shows that it is possible to predict future dyslexias in a fairly large percentage of three, four and five-year olds who are originally referred on account of motor-speech delay, developmental word-deafness and severe dyslalia.

According to Orton certain children suffer from a generalized language disability which

manifests itself in disorders of oral or printed language or both. Weiss affirms the existence of such a generalized factor and calls it "central language imbalance."

For the purpose of investigating the nature of this language disability we have examined the motor, perceptual and emotional performance of our children and have found a number of basic and specific dysfunctions which seem to underlie a variety of language disturbances.

A number of tests show that these youngsters often do relatively poorly in abstract performance in spite of good intelligence. They frequently have difficulty in finer muscular control; some of them show a degree of dyspraxia. Many are late in establishing cerebral dominance and have trouble with right—left progression. Bender Gestalt tests show striking immaturity of visuo-motor functioning. Body image is usually very primitive. These children show disturbances in figure-background relationships, they are often hyperactive and have difficulty with patterning of motor and behavioral responses. They have, in fact, trouble at every level of integration.

According to Gestalt psychology the ability to experience and to respond in terms of Gestalten is a fundamental principle of psychophysiological functioning. It is our hypothesis that deficiencies in this area are responsible not only for our children's inferior performance on certain non-verbal tasks, but that they are also at the root of a number of language deviations. We feel that the crucial factor in central language imbalance is difficulty with structuralization and organization of perceptual and motor configurations. Differentiation between foreground and background is often faulty. These children have trouble recognizing and reproducing the dimensional and organizational details which make for the structural coherence of the Gestalt.

Research done at Bellevue Hospital in New York City, the investigations of Professor Zazzo and his collaborators in Paris, and our own clinical observations point to maturational delay as a significant factor in language disorders. These theoretical considerations bring up certain practical problems for speech therapy which are discussed in the paper.

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SCHIZOPHRENIA IN IDENTICAL TWINS ONE OF WHOM WAS LOBOTOMIZED[1]

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Schizophrenia in identical twins was first sharply delineated in the two girls, Kaete and Lisa St. (9). In this monumental study by Kallman, the case histories of these two individuals became famous because they both developed schizophrenia only 16 months apart even though they were separated shortly after birth and had quite different environmental factors in their lives from that time on.

It is indeed noteworthy that his studies (9) revealed that the probability of schizophrenia developing in the full sibling of a known schizophrenic is 14.3 per cent, while the probability of schizophrenia developing in the identical twin of a schizophrenic is 85.8 per cent. The percentage of schizophrenia in the public is approximately 1 per cent.

In the research on various diseases, the use of controls has added scientific exaction. However, many chronic diseases in human beings have not lent themselves easily to the use of controls. In mental diseases, this desirable scientific condition has been rarely found. The following study is one of schizophrenia in identical twins who received quite different treatment. One was lobotomized; the other was not.

The family history of the subjects reveals that the paternal grandfather died at the age of 76, of unknown causes. The paternal grandmother died at the age of 49 of a "stroke." The maternal grandfather died of a "senile psychosis" at the age of 60, and the paternal grandmother died of a "stroke" in her 76th year. The father of the patients, described as having been very strict, died at the age of 52 of a heart attack. The mother of the twins is still alive and is a warm individual who is quite interested in her children and exhibited some emotional understanding in saying: "Tom[3] is so babyfied. I think I have tied him too strongly to my apron strings." There were 11 children: a sister, born in 1904, who was admitted to a mental hospital at the age of 28; a sister, born 1906; a sister, born 1907; a brother, born 1911; a sister, born 1913; a brother, born 1915; *the subjects, born 1917;* a sister, born 1924; a brother, born 1925; and a sister, born 1930. Aside from the institutionalized oldest sister, there is no other evidence of taint in the immediate family.

The subjects were born about two minutes apart in January, 1917. Monochorionicity was not determined. One twin weighed 6½ pounds; the other, 7 pounds. About the age of one year, they both developed "bronchitis," and the family physician expressed fear that this would result in tuberculosis—which, however, did not occur. In their early lives, Tom was always about one pound heavier and one inch taller than John, yet even their mother had difficulty in telling them apart and later stated: "I cannot make much difference in the two. They always got into the same kind of mischievousness and the same kind of trouble." Nothing unusual in their early life was noted by their family although after the onset of his psychosis, Tom said that he had always been lonely and had never gotten along with his brothers. Their activities were closely parallel until they reached high school, at which time Tom chose a commercial school while John remained in the regular high school. They both liked athletics and did well in baseball, even considering going into commercial sports. They were excellent dancers, went to the same social events and neither developed any definite interest in a steady girl friend. Both quit high school in the third year at the age of 17—the same year that their father died. As their sister had entered a mental hospital only two years before, this must have been a traumatic

[1] Read before the Southern Psychiatric Association Meeting, October 5, 1953, at Biloxi, Miss.

[2] From the Veterans Administration Hospital at Gulfport, Miss.

[3] The names of the subjects have been changed. John was lobotomized.

period for them. They began working at odd jobs in the same city until November of 1936, when Tom enlisted in the Army. Their paths began a temporary divergence. Seven years later, they were on the same ward in the same hospital with the same mental disease.

Tom remained in the Army until September of 1938 when he "purchased" his discharge, returned home and did odd jobs until November of 1940, when he enlisted in the Marine Corps. Thirteen months later, John also enlisted in the Marine Corps, making an apparently adequate adjustment until March of 1942 when, aboard ship in the Atlantic, he became abruptly psychotic, hearing voices and being very fearful. He was hospitalized at that time.

Six months later, in California, Tom began to hear voices calling him "queer" and he became suicidal. He was hospitalized until February of 1943, at which time he was discharged and returned to his home. Two months later, his twin was also discharged and returned home. Neither of the twins was able to make a satisfactory adjustment, although John did various menial jobs. Tom felt that people called him a slacker and became surly and argumentative, finally threatening to kill his mother and himself. In December of 1943 he was hospitalized, at which time he was depressed, tearful and preoccupied with homosexuality, and was considered to be suicidal. He was diagnosed as dementia praecox, hebephrenic type. Two months after Tom was hospitalized, John visited him and became acutely psychotic, thinking he was going insane, and developing ideas of reference. He drank paragoric in June of 1944, at which time he was hospitalized. When he was admitted, he was worried over his twin and had bizarre delusions: "My eyes are popping out." He was restless and depressed, but improved after he was placed on the same ward with his brother. He was diagnosed as dementia praecox, simple type.

In August, 1944, Tom was placed on a trial visit, after which his twin eloped from the hospital. Both returned home but their behavior was somewhat different in that Tom became nomadic, worked at odd jobs and became guilty over gambling at the race track. He continued to have ideas of reference and talked about suicide, but was able to make a minimal extramural adjustment for two years. His twin was not able to do even this and was returned to the hospital after 15 months at home. When admitted, he stated: "I look insane, my mind is stewed." He was restless and was disturbed by many somatic delusions. One month later he again eloped from the hospital and returned home, where he continued to be actively psychotic.

In August, 1946, both twins were readmitted. John was very delusional in the somatic sphere: "My arms are shriveling." His brother exhibited more concern with homosexuality and guilt, stating: "I wish God would strike me dead. I wish they would send me to prison." It is interesting to note that the twins showed antipathy toward each other at this time. They both received a course of electric shock, with more improvement noted in Tom. Six months later, John eloped from the hospital and returned home. He again made an abortive suicidal attempt by drinking mercurochrome, shortly after Tom returned home on a trial visit. In this tandem fashion, John was returned to the hospital in March, 1947, at which time he was grossly disturbed—hostile, hallucinated and delusional. He felt that his eyes were sinking into his head and would stare into a mirror for hours. He received two courses of electric shock with little improvement and in September, 1948, he received insulin shock but remained hallucinated and delusional. Later, however, he gradually improved and was given a trial visit in February of 1950. He was unable to adjust at home and was returned to the hospital in two months. He again showed slight improvement and eloped from the hospital in September of 1950. One month later he was returned, following threatening, assaultive behavior. He required extensive sedation and hydrotherapy. During this stormy period of his illness, his twin Tom was able to remain at home but he was fearful, felt he was persecuted and was unable to work.

In July, 1952, at the age of 35, John received a modified Freeman-Watts prefrontal lobotomy. Following this, his clinical picture changed dramatically in that he showed less concern for his "voices" and he became cheerful, aggressive, and boisterous. His attitude was flippant and he complained a lot but his relations with others was better and he de-

veloped a coarse sense of humor. He steadily improved and was given a trial visit in February, 1953. His mother stated that he was better than he had been in years. He showed no evidence of depression, hostility, or concern with delusions, and he became active in his environment and interested in working.

However, John's homecoming had a deleterious effect on his twin who became depressed, anorexic and tearful. He was readmitted in March, 1953, stating: "I didn't hurt nobody." He was withdrawn, apologetic, and confused. His depression lifted after he received 12 electric shock treatments but he remained passive and indecisive. In July, 1953, Tom was placed on trial visit. At that time, both twins were examined. John, the lobotomized twin, showed an impressive improvement since his operation. He was quiet, cooperative, in good contact and showed no hallucinations or delusions. He remembered and warmly greeted members of the personnel and no longer showed the gruff attitude he exhibited at the time he was placed on trial visit. He still had little real concern for his brother, and their meeting was mutually almost devoid of emotion. At this time Tom showed tension and mild depression. He continued to lack decisiveness and was very passive. He undoubtedly found a vent for his hostility through this mechanism and passively blocked nearly all suggestions with: "Whatever you say, sir. You're the doctor and I have to do what you say." He was also suspicious of friendly gestures and doubted that he was going home, although he was assured and reassured of such. The obvious effort he expended to control his emotions was at marked variance with the relaxed attitude of his twin.

A physical examination was done at this time. Their appearance, anatomical measurements and comparisons were nearly identical and satisfied the criteria for the proof of monozygosity set down by Newman (10).

Prior to lobotomy, John was given the Wechsler-Bellevue Adult Intelligence Scale, Form 1, scoring a Verbal Scale I.Q. of 107, a Performance Scale I.Q. of 88, and a Full Scale I.Q. of 98. He was given a Rorschach and the admission battery of tests (Bender-Gestalt, House-Tree-Person, Sentence Completion, and revised TAT) which revealed strong verbal hostility: "I don't love anyone at the present time. I hate the VA and everyone knows it," and projection: "I am mentally deranged due to 25 years of cruelty." However he showed sufficient control to keep from becoming a severe behavior problem. The pressure exerted in his drawings was indicative of hostility, tension, and anxiety. Human figures were drawn without hands and arms which was indicative of helplessness and impotence. The patient also gave evidence of hallucinations and homoerotic conflict, and a fairly strong depressive trend was noted, this appearing prominently in the Rorschach.

John was again given the Wechsler-Bellevue and Rorschach approximately ten weeks after lobotomy. His Wechsler-Bellevue scores then were a Verbal Scale I.Q. of 102, a Performance Scale I.Q. of 88, and a Full Scale I.Q. of 96.

In comparing pre- and post-testing, it was noted that there were very minor differences in the Wechsler-Bellevue scores. The Performance I.Q. score was the same while the Verbal I.G. score was somewhat reduced. Subtests showing minor loss on post-testing were Digit Span, Arithmetic, and Digit Symbol—these being tests, according to Wechsler, that may be affected by organic involvement. The post-testing data was such as to suggest there was no marked over-all loss in mental ability. The Rorschach test contained some minor evidence of loss of mental efficiency. On the pre-test John gave 25 responses, while on post-test he was able to produce only 19. Color naming appeared in post-testing, and more time per response was taken. These are common Rorschach indices of organicity. The approach was still a large detail one, and there were still Rorschach signs of anxiety and depressive trends. No bizarre responses were given and F+% was higher, reflecting an improved grasp on reality.

His twin, Tom, was also given the Wechsler-Bellevue, the Rorschach and the admission battery of tests. On the Wechsler-Bellevue, he scored a Verbal Scale I.Q. of 98, a Performance Scale I.Q. of 93, and a Full Scale I.Q. of 96. On the admission tests battery, Tom revealed considerable anxiety, and hostility was

also seen, but this appeared to be directed inwardly with self-depreciative, self-accusatory, and submissive reactions noted. He seemed willing to put himself in the hands of the doctors and do whatever they planned for him, but this overt submissiveness concealed oppositional and hostile motives. There was considerable evidence of religious ideation and also sexual preoccupation—his drawings showing in a pronounced manner the genitalia of both sexes. Tom, according to the clinical and test data, was not actively psychotic at the time of testing, and it could not be stated that a lobotomy was indicated for him at that time.

Discussion

Identical twins offer a unique opportunity for the study of human behavior and of human disease. In emotional disorders, great difficulty has been met in attempting to satisfy scientific probity in establishing suitable controls. This difficulty is most nearly dissolved in identical twins.

Statistically, twins occur about once in every 85 births (7) and of these, approximately one third are identical. Twins have always been of interest to the laity and of especial interest to geneticists and obstetricians. A constant aura of mystery has surrounded twins in primitive cultures and in legends of antiquity. Certain Indian tribes of British Columbia believe that twins can control the weather, as do the Bantu of Africa (4). Apollodorus of ancient Greece tells of two mythical twins—Otus and Ephialtes—who were inseparable, cared only for each other, and accidentally slew each other. This thinly-disguised ambivalence is more critically noted by Fenichel: "Twins readily develop ambivalence and jealousy, an intermingling of a feeling of dependence, in the sense of needing a supplement to become a whole, and a hostile reaction stressing of independence (3)." In German legend, if a person meets his counterpart (doppelgänger) he will soon face disaster. In the case history we have, one twin visited his double in a mental hospital and immediately became acutely psychotic. He was sent to the same mental hospital and, later, to the same ward.

The family history of these twins reveals that one sister had a mental disease requiring hospitalization. Presuming that this full sibling had schizophrenia would increase the probability of her full siblings developing the disease from 0.85 per cent (public at large) to 14.3 per cent according to Kallman (8). In his study, fraternal twins develop the illness in 14.7 per cent of the cases—which is close to the percentage (14.3) of full siblings' chance of morbidity. However, if one of non-separated identical twins develops the disease, the other develops the disease in 85.8 per cent of the cases. In another report, Rosanoff et al. (11) give the percentage of both becoming affected, after one developes schizophrenia, as 14.9 in fraternal and 68.3 in identical twins.

In the twins, John and Tom, it is noted that their early development, adjustment and interests were almost identical. They were described as being very close and usually attended the same social activities, both liked baseball and were about equally proficient in this sport. However, a noticeable schism began at the age of 15 when they chose different high schools, and this widened when Tom alone enlisted in the Army at the age of 19. Afterwards, they both enlisted in the Marine Corps and became psychotic within six months of each other, although they were several thousand miles apart.

There have been many instances of twins developing the same somatic illnesses almost simultaneously, having similar thought-processes, and following the same activities and work although separated or even complete strangers to one another. Stern (12) comments: "It is, of course, true that the mental reaction to illness of his twin partner of an identical twin who is aware of his great similarity to this partner is probably different from that of a non-identical twin who knows that his fate is dissimilar in many other ways." At any rate, Tom developed acute psychotic symptoms after learning that his brother was ill in the Marine Corps, John became acutely psychotic after seeing his twin in a hospital, and Tom had to be hospitalized when his greatly-improved lobotomized twin returned home.

The illnesses of these twins is now of ten years' duration. There has been a noticeable difference in their symptoms and behavior. John showed much more disturbed behavior—i.e., attempting suicide twice, eloping from the hospital several times, having vivid delusions and hallucinations

("My eyes are popping out," "My arms are shriveling up") being assaultive, and, in general, having a stormy illness with definite exacerbations and partial remissions. Conversely, Tom showed more guilt, depression, feelings of hopelessness, preoccupation with homosexuality, and less activity and bizarre ideas. This disparity of symptomatology as seen here is considered to be the usual case rather than the exception by Rosanoff et al. (11), although Kallman (8) believes that the difference in the symptomatology of schizophrenic identical twins is observed only in those cases showing a definite variation in the age of onset. There was only six months' variation in these twins.

It is significant to note the similarities in the test data of John and Tom. While there are minor differences in sub-test scores and in verbal and performance scores, the Full Scale I.Q. scores of each are markedly similar: John, the lobotomized twin, scored 98 and Tom scored 96. In both cases, there was some loss on performance tests as opposed to verbal tests, this deficit being related to the presence of psychotic process existing in both. On the Rorschach, both gave a similar number of responses (John, 26; Tom, 25). Both had a large detail approach. John showed stronger affective components—color, shading, and blackness of cards being more frequent determinants in his protocol, while Tom's higher F percentage indicated greater intellectual control and restricting of affective components. Oppositional trends appeared in the records of both. It is significant to note that aggressive factors had existed in both of the twins, but there was a difference in the method of handling the aggression—John tended to direct his aggression outwardly while Tom tended to direct his inwardly. It may also be said that psychosexual conflict existed in both twins, there being evidence of sexual preoccupation, of homoerotic components and some suggestion of feminine identification in each. While they showed different methods of handling their conflicts, their conflicts appeared to be basically similar.

Lobotomy was considered in John's case after conservative therapy (electric shock and insulin shock) failed to give more than transient improvement. He remained a chronically-disturbed schizophrenic, which alone is considered an indication for psychosurgery by Freeman and Watts (5) and Strecker et al. (13). His "fixed state of tortured self-concern" was also an indication, according to Arnot (2). The chronicity of his illness satisfied the qualification that the operation can be considered for "mental states of long standing accompanied by affective symptoms and overemotionality which have not responded to more conservative types of therapy (6)." Further, the psychological report prior to lobotomy revealed acute anxiety and painful affect.

Ths operation was a bilateral modified Freeman-Watts lobotomy. The incisions were made to a depth of 5 cm. in the plane of the coronal suture immediately anterior to the anterior horn of the lateral ventricles.

John made a steady improvement following psychosurgery. His psychological test revealed less sexual preoccupation and aggressiveness and, while he continued to hear voices for several months, these gradually faded. At the present writing, one year after his operation, he was found to be free of hallucinations and disturbing delusions. He was very interested in helping around the house and showed a predilection for work of the type Ackerly (1) calls "quantity instead of quality," as seen in his wanting to scrub the floors daily and wax them excessively. His social adjustment was better, he was happy and self-satisfied and, through his own initiative, obtained a job in a garage that he still holds. Tom will probably return to the hospital later, as he has very painful symptoms in his acute phases, and he remains chronically ill. His ability, however, to improve rather rapidly with hospitalization and to stay out of the hospital for as long as five years has deterred the recommendation of psychosurgery for him. Should he be able to maintain this tenuous adjustment, he and his brother will be examined periodically, as it is believed that they are a rare, adequate control study of the effect of psychosurgery on schizophrenia. If, however, psychosurgery is ultimately recommended, it is conjectured that similar incisions severing similar nerve pathways in nearly identical brains will produce the same gratifying results.

Summary

1. A study was made of a set of identical twins who developed schizophrenia within six months of each other.

2. Genetic factors and the similarities and differences of their disease were discussed.

3. Lobotomy was performed on one of the twins with excellent results.

4. It is believed that these twins offer an adequate control situation for study of the effect of psychosurgery on schizophrenia and future examinations are planned. If psychosurgery is ultimately recommended for the other twin, it is believed that the operation will produce very similar results.

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PSYCHOSES DUE TO AMPHETAMINE

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Benzedrine was introduced in 1937 by Prinzmetal and Bloomberg (14) for treatment of narcolepsy. Together with its dextrorotatory isomer it has since become a fundamental drug in general medicine and the specialties. It is widely employed in the treatment of depressive states, obesity, Parkinsonism, behavior disorders in children and alcoholism. It is also extensively self-prescribed because of its ability to produce feelings of euphoria and mental stimulation. Drug addicts are known to substitute if for other less easily obtainable euphoriants.

Although it was soon recognized that psychiatric reactions to benzedrine occur, only few such reports have appeared in the literature. It is our impression that many more such reactions occur than are reported and that many reactions are not clinically diagnosed. Because of the widespread use of the drug by prescription or self-medication, it is important to emphasize the possibility of severe psychiatric reactions to the drug such as this paper reports.

In 1938 Apfelberg (2) reported a case of benzedrine poisoning in a patient who deliberately took a large dose. Young and Scoville (18) first pointed out the danger of precipitating a psychosis with benzedrine. They reported in 1938 a case of two white males who, during treatment of their narcolepsy with benzedrine, developed acute paranoid types of psychoses with ideas of reference, delusions and auditory hallucinations in a setting of apprehension and confusion. One of the men recovered in five weeks, while the other still experienced hallucinations one year later, accompanied by defective insight, although he was able to maintain gainful employment. These authors believed that a latent paranoid state was present in these two patients with narcolepsy and a psychosis was precipitated by the use of benzedrine. They therefore suggested that patients treated with benzedrine be scrutinized carefully for psychiatric symptoms prior to therapy.

In a paper in 1939 dealing with experimental studies of the toxicity of benzedrine, Ehrich, Lewy, and Krumbhaar (4) cited the case of a 27-year-old male manic-depressive patient. This man became euphoric and excited after a dose of 350 mg. of benzedrine, escaped from the hospital with a large supply of benzedrine and ingested, according to his own report, about 20 g. within a two-day period. When he was found, he was in an acutely psychotic state with paranoid delusions and hallucinations. He subsequently recovered uneventfully after barbiturate sedation.

The United States Public Health Service (16) studied the use of benzedrine in the treatment of morphine addiction. In a report in 1944, seven addicts, who had many abnormal features in personality organization, were given daily doses of benzedrine up to 1 g. Six of the patients rapidly developed acute anxiety which progressed to psychotic symptoms, but these cleared promptly with the discontinuation of the drug. Unfortunately the character of the psychoses was not given in the brief report of this work.

Norman and Shea in 1945 (12) reported the case of a 49-year-old lawyer who, after taking benzedrine daily for five years in doses up to 250 mg., developed a paranoid psychosis with visual and auditory hallucinations, hyperactivity, and combativeness. Prior to the use of benzedrine, originally prescribed for fatigue, he had been a severe alcoholic. He gave up the use of alcohol after becoming habituated to benzedrine. His psychosis lasted five months, clearing after 30 days of hospitalization. The authors emphasized the tendency toward benzedrine habituation in neurotics, alcoholics and drug addicts.

Nielsen (11) in 1947 described a delirium of four days' duration in a man who had ingested a large quantity of alcohol, about 250 mg. of benzedrine, opiates, and some pills containing caffeine. His recovery was complete. The role of benzedrine in the production of this acute psychosis cannot be adequately estimated.

In 1948 Schneck (15) reported a case under the title of "Benzedrine Psychosis". The patient

TABLE I—PERSONALITY FACTORS.

Case No.	*Sex*	*Race*	*Age*	*Marital Status*	*Work History*	*"Psychopathic Traits"*
1	F	White	23	Separated	Poor	Promiscuity; "amnesia"
2	M	Negro	31	Separated	Poor	Dishonorable discharge, disobeyed order in combat
3	M	White	37	Divorced	Poor	Drug addict
4	M	White	37	Married	Poor	Jail sentence; malicious mischief; delirium tremens, 1939
5	M	Negro	23	Single	Poor	Sentence for burglary
6	M	Negro	23	Separated	Poor	Psychotic mother; illegal acts on ship; separated from wife
7	M	White	32	Single	Poor	Drug addict; arrests for assaults and gambling
8	M	White	33	Single	Fair	None

was a soldier, 28 years of age, with a poor family background and a long history of antisocial behavior, who, while in an army disciplinary barrack, developed an acute psychosis, following the ingestion of 375 mg. of benzedrine within 36 hours. He became confused, excited and fearful for his life. This was accompanied by auditory and visual hallucinations. The psychotic state cleared completely within 48 hours. This author stresses the fact that ingestion of the contents of benzedrine inhalers is a common method used for taking the drug. He also made the point that benzedrine psychosis is most likely to occur in psychologically predisposed individuals. Our patients also demonstrated these observations.

The smallest dose recorded as having produced an acute psychotic reaction was reported by Wallis, McHarg and Scott (17). They published in 1949 the case of a petty officer in the British Navy who, following a single average dose of dextro-amphetamine (dexedrine), became semi-stuporous and hallucinated. He continued to hallucinate for a day although he soon became oriented. By the end of 21 hours, he recovered.

In 1947 Monroe and Drell (9) reported the development of acute paranoid, hallucinatory psychotic states in four prisoners who took doses of benzedrine ranging from 93 to 250 mg., obtained from inhalers.

In the literature from 1948 to the present (1, 3, 5, 6, 8, 10, 13) there are a few reports discussing addiction, schizophrenic reactions, and delirious reactions to amphetamine. The reports in the literature describe several acute psychoses following the use of benzedrine or dexedrine. The type of psychosis is usually paranoid and hallucinatory, in a setting of mental confusion. Recovery was, as a rule, prompt following the withholding of the drug although, in one case, a chronic psychotic condition persisted. Noteworthy is the fact that the prepsychotic personality of the patients showed many abnormalities usually associated with psychopathy. A common method of obtaining benzedrine—by ingesting the contents of inhalers—is described in the literature. This provides a dose of 250 mg. of the drug in one inhaler.

CASE REPORTS

Our records describe eight patients who developed reactions to benzedrine. Table 1 summarizes the personality data; table 2 gives the data on the amount and duration of the use of benzedrine and the presence of other drugs. Table 3 gives the data on the toxic and psychiatric symptoms. A brief case history of a patient with a typical psychotic reaction to benzedrine follows.

C. P., a Negro male, 23 years of age, was admitted to the hospital in a state of panic. He was extremely apprehensive, suspicious of his surroundings, and responding to auditory hallucinations. However, he

TABLE 2.—DRUG DATA

Case No.	*Use of Alcohol*	*Use of Other Drugs*	*Duration of Use of Benzedrine*	*Daily Average Dose*	*Method of Use*
1	None	None	One year	500 mg. (1 mo.)	Chewed contents of inhalers
2	Excess	Marihuana, Morphine, cocaine	One month	250 mg.	Chewed contents of inhalers
3	Beer	Morphine, heroin—16 yrs.	One month	250 mg.	Chewed contents of inhalers
4	Excess	None	Single dose		Chewed contents of inhalers
5	Moderate	None	Single dose		Chewed contents of inhalers
6	None	None	Single dose (?)		Chewed contents of inhalers
7	Excess	Marihuana, morphine—9 yrs.	Three days	250 mg.	Chewed contents of inhalers
8	Excess	None	Three days		Chewed contents of inhalers

TABLE 3.—EFFECTS OF TOXICITY

Case No.	*Delusions*	*Auditory Hallucinations*	*Visual Hallucinations*	*Autonomic Effects*	*Duration*	*Outcome*	*Reaction Type*
1	+	+	+		6 days	Recovered	Toxic
2	+	+	?		Indefinite	Chronic psychosis	Schizophrenic
3	+	+	+	Pupils 104; dilated pupils	About 32 days	Recovered	Toxic
4	+	+	+	Pupils dilated	One day	Recovered	Toxic
5	+	+	+		23 days	Recovered	Toxic
6	+	+	0	Rapid pulse, dilated pupils	25 days	Recovered	Toxic
7	+	+	+		Indefinite	Chronic psychosis	Schizophrenic
8	0	0	0	Anxious, dry mouth, rapid pulse, choking, insomnia	One week	Recovered	Neurotic

was correctly oriented and gave fairly relevent responses to questions. He said: "Yesterday I took benzedrine to feel high. They all talk about me. All New York knows about it. You know one thing leads to another." No visual hallucinations were present. Physical examination revealed a tachycardia and dilated pupils.

Relatives gave the history of the sudden appearance of agitation, fear, and delusions of persecution, finally necessitating his hospitalization. It was not possible to ascertain the amount of benzedrine taken, although the patient admitted chewing the contents of benzedrine "containers" in an effort to get "high."

For three days following his admission he continued to be excited, apprehensive, delusional and hallucinated. He feared that he was to be poisoned, talked a great deal about "a gang going to shoot me, and you guys are in on it." At the end of this period he rapidly improved and soon gained complete insight, attributing his delusions and auditory hallucinations to "benzedrine imagination." He was discharged as recovered from a drug psychosis after five days of hospitalization.

The premorbid history indicated that there was a high degree of psychopathy in personality organization. His family history revealed that his mother was afflicted with a chronic psychosis, probably schizophrenic, and had been institutionalized. He worked irregularly, sometimes as a merchant seaman. Recently he had been suspended from his work because of his becoming involved in evading the declaration of import duties on goods from other countries. Although he was married and had two children, he was separated and lived with another woman.

He showed a type of personality organization

common in a group of addicts. His psychiatric state was a type of toxic hallucinosis akin to that commonly seen in alcoholics in the form of alcoholic hallucinosis. The rapid course and quick recovery are features prominent in this type of reaction.

Discussion

In our series there were seven cases of psychotic reaction to benzedrine, and one case of an anxiety tension state produced by this drug. There was only one woman in the group. It is notable that there is not in the literature, as far as we are aware, another report of a benzedrine psychosis affecting a woman. The marked predominance of the male in our series corresponds to the greater frequency of other toxic drug psychoses in the male. The rarity of the psychotic reaction to benzedrine in the female may merely reflect the greater use of the drug in excess by male habitues.

The ages of the patients varied from 23 to 37. The histories of those who developed a psychotic reaction uniformly revealed evidences of social maladjustment and psychopathy. This was borne out by the poor marital adjustments and poor work records. Antisocial activity was prominent in this group and this included difficulties with the law and a high incidence of addiction to other drugs and alcohol. Individual characteristics and premorbid background are important factors in determining the manifestations of drugs that produce toxic effects. Malamud and Lindemann (7) said: "The changes produced by a given drug will not only be elaborated on in the light of the preexisting psychic state but totally new reactions may result from such an inter-relationship."

The average daily dose of benzedrine in our cases was from 250 to 500 mg. Two, possibly three, patients developed the psychotic episode following a single dose of 250 mg. One patient took the drug for only three days, while another patient took the drug in moderate doses for one year and then increased it up to 500 mg. daily for a month preceding her psychotic reaction. The patient who developed an anxiety tension state took the drug for only three days.

The dosage reported in the literature varied more widely than in our cases. The patient reported by Norman and Shea took the drug daily for five years prior to the outbreak of the psychosis. The acute psychosis reported by Wallis, McHarg and Scott purportedly developed following a small (therapeutically prescribed) dose.

All our patients took the drug by chewing the contents of benzedrine inhalers or dissolving the contents of the inhaler in a beverage.

The typical clinical picture was a paranoid psychotic reaction with a minimal disturbance in the intellectual and cognitive functions. All the psychotic cases manifested delusions associated with auditory hallucinations. Visual hallucinations were also a prominent feature. The hallucinations were vivid and accompanied by a state of excitement, usually with fear and agitation. Autonomic effects, chiefly rapid pulse and dilated pupils, were noted in three of the psychotic reactions, and were prominent also in the single neurotic reaction.

The duration of the psychotic state varied from one to 32 days, except for patients who developed a chronic psychotic state of a schizophrenic type. The patient with an anxiety tension state recovered in about one week. His chief manifestations had consisted of anxiety, choking sensations, insomnia, rapid pulse, and dry mouth.

The psychotic reaction following benzedrine toxicity resembles that seen in other toxic states, particularly in alcoholics. We were careful to evaluate the alcoholic factor in this group of patients and we believe that, in the five patients who used alcoholic beverages excessively, this was a minor factor or no factor in the present psychosis.

Summary

1. Eight cases of psychiatric reaction to benzedrine are reported.

2. The typical reaction is essentially that of a paranoid psychosis with auditory and visual hallucinations in a setting of agitation and excitement. Recovery takes place in one to 32 days. In some instances (two patients) a chronic response of a schizophrenic type will develop.

3. The clinician should be alert to the possibility of benzedrine as a cause of toxic psychotic reactions.

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RECURRENT DREAMS IN MIGRAINE: AN AID TO DIAGNOSIS

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Three different dream patterns appear so frequently in migraine that the recognition of these dreams may be used as a diagnostic aid. In twenty-two years of clinical studies of migraine I have found it necessary to classify as *migrainoids* a large group of migraine sufferers whose presenting symptom is not a classic headache. These patients exhibit a variety of recurrent symptoms which are often obscure and puzzling to the doctor. *Migrainoids* are persons who are direct descendants, or siblings, of individuals who have recurrent, classic migraine headaches.

When confronted by a patient who, for one reason or another, is unable to give a *family history* of migraine headaches, but whose recurrent symptoms are consistent with the migraine syndrome I proceed to take a history of his dreams. If the dreams fall into any of the three patterns described in this article, I feel warranted in advising treatment for migraine.

So far as I am able to ascertain, these dream patterns appear *only in sufferers from classic migraine, or in migrainoids.* They are characterized by:

1. Recurrence.
2. They usually occur in brilliant colors. (Note: Doust (1) also notes that brilliantly-colored dreams predominate in migraine.)
3. They appear at *specific* times in the life-span of the patients.
4. They are characterized by certain emotional *tones* which usually carry over, sometimes for hours, into the waking state.
5. In some cases the dream is so vivid that it persists as a hallucination after the patient is wide awake (2).

Dream Pattern #1: The Nightmare. These dreams begin in early childhood, recurring frequently until the 10th or 12th year. Some patients remark that their dream "began as far back as they can remember." In rare cases the dream may recur infrequently in adult life, usually during or following periods of illness. In such instances it is remarkable that the dream is *identical in detail* with that of the early childhood years.

The nightmare is characterized by an intense "soul-shaking horror," or "cold terror," and panic suffered by the dreamer. The emotional tone is often described as being all out of proportion to the dream situation. Chiefly of interest here is the fact that the feeling of horror, terror, or panic lingers far into the waking state, sometimes for hours.

Patient F., who has these horror dreams in adult life, writes:

". . . I am always acutely aware of a sickening sense of horror, fear, and unreality which I am unable to throw off for as much as an hour or two after waking. Even now (as I write) the effect of last night's experience still hangs about me."

This horror dream is one in which various distorted and colored objects, either animals, abstracts, or beings, converge upon the dreamer, who feels he is unable to run or move to avoid them. Often just as he is about to be overwhelmed, the converging objects recede, and the enire process begins anew. In other cases the dreamer awakens at the point of being overwhelmed. Those patients who have dreamed the process in repetition have noted that the state of sleep is extraordinarily deep. Others state that when the dream began, apprehending the horror which was to follow, they learned to "will" themselves awake, or to "stop" the dream.

Case 1. Mrs. M. B., age 30, court reporter. Recurrent dermatitis on hands and back. Mother had classic migraine.

"I recall having the dream . . . as far back as I can remember, up until about the age of thirteen or thereabouts. I suppose it remains vivid in my memory chiefly because of the terrible fear which I suffered from it. It was not a dream of places, or people, but of abstract patterns.

"It always began with an impression of being in howling darkness, accompanied by a whirling sensation such as one experiences in 'going under' ether. Presently, to the right and left, far above me, vague patterns would materialize and grow and grow and grow until it seemed they were converging upon me.

During this time both abstracts and I were whirling madly. As the shapes grew larger, they took on brilliant colors and sharp lines.

"I don't recall that there was any particular form or shape to them; I only knew, whenever I had the dream that they seemed familiar, and inspired an unreasonable terror, and a desire to get away from them. In the dream they never quite converged upon me; sometimes I would wake up, but sometimes, just as they were about to crush me, they would suddenly recede, and the whole process would begin over again.

"During these dreams I was in such a deep sleep, and screaming so frightfully, that my family had to walk me up and down, and finally would pour some salt on my tongue, the taste of which would waken me."

Case 2. Mrs. J. E., age 43. Recurrent attacks of depression and occasional severe migraine headaches. Migraine in father's family.

"As a child I had a constantly recurrent night mare which frightened me greatly each time, no matter how often I had it. In fact, I began to be terrified as it started, as I well knew what was coming. It began as I walked down the long, dark service hall in my mother's house at the end of which was the door to my father's den . . . The feeling of terror and compulsion mounted until I opened the den door and quickly switched on the light. There on the raised stone hearth, in front of the massive fireplace, sat a cat, an ordinary gray cat with green eyes. As I stood there rooted to the spot, the cat grew and grew until it filled the whole room, all the while keeping me fixed with evil green eyes. Just as I was about to be enveloped by this ever-growing mass, the terror would be more than I could bear and I would awake, afraid to go to sleep again for fear that I should wander once more down that dark hall.

"This dream lessened and finally disappeared when I entered high school."

Case 3. Mr. H. G., age 40, radio commentator. Recurrent abdominal symptoms. Mother and grandmother had migraine headaches.

"The . . . dream was a true nightmare, and always in color. Two grindstones, big as ferris wheels, revolved and moved toward each other so that the rims would ultimately touch, like gears. I was bound to one of the wheels, and at the point where they would meet, something like an opera box, in which my family would be seated. They would sit in silence as I screamed, waking at the final moment.

". . . It should be mentioned that I was able to wake myself at the beginnings of the nighmares after awhile . . ."

Case 4. Mr. J. B., age 42, manager of automotive parts. Migraine headaches during adolescence. Mother had migraine headaches.

"When I was four years old I was subject to nightmares. These occurred on an average of once or twice a week for a period of about six months as I remember my parents telling about it. Although it is now 37 or 38 years since having these nightmares I can still very vividly remember them.

"They followed the same pattern each time, namely: some sort of an animal was endeavoring to crush me but never seemed to get hold of me, and the animal seemed to be a large furry brown bear. My parents tell me that these attacks would last for as long as one-half hour during which I would scream and kick but they couldn't get me awake. When I did finally waken I was worn and spent."

Case 5. Mrs. L. K., age 48, social worker. Recurrent rages. P. E. Negative. History of family unobtainable.

"From my earliest recollections as a child to the time of adolescence I was subject to . . . nightmares. They always took one of two forms—the most usual, I could see large masses of rising bread dough . . . these mounds of dough kept swelling or rising into larger and larger mounds, gradually closing in on me. At the moment when I was about to be engulfed on every side and from above, I started to vomit.

"Another variation of the nightmare was the accumulation of bricks, rather than dough. A low wall of red bricks in the distance would grow in size and closeness, moving nearer and growing in height and size until it engulfed me.

"I recall no recurrences after the onset of puberty."

Dream Pattern #2: The Nostalgic Technicolor Dream. This recurrent dream first appears around the age of 12, at the beginning of puberty. In many cases it *replaces* the "nightmare." It lasts until about the 18th year, and in a few cases, recurs infrequently throughout adult life. It is noteworthy that the appearance of this dream often coincides with the first appearance of recurrent migraine headaches in the lifespan of the patient.

This dream is always vividly and gorgeously colored. It is a dream of *locale*—of a place to which the dreamer "returns" time after time, with a feeling of haunting familiarity. It is repeated in identical detail. It has no apparent relation to any place the patient has ever actually visited or seen. It is characteristically a *deja vue* dream, accompanied by a sense of nostalgia, longing, loneliness, and/or sadness. This emotional tone lasts long into the waking state. For purposes of brevity I include just two typical descriptions from my collection:

Case 1. Mrs. C. R., age 44, newspaper columnist. Has recurrent migraine headaches. Mother and

two sisters have migraine. "In this one dream I would go down a long, isolated road, not at all unfriendly, but lonely. I'd come to what you might call a castle; it was a large, palatial place. I'd enter it as though I belonged there, or rather, as if it belonged to me.

"When I first went in, I would know what to expect, and then as I went through it I'd have a sense of having been there before.

"It was the most beautiful place you ever saw; the detail of tapestry and hangings and small objects on the tables was of beauty such as I couldn't conceive during my waking moments.

"I walked through this place, enjoying it thoroughly. There was not a soul there. Then I'd go quietly out a side rear entrance and go on, sad and happy, down a little road.

"I've gone back to this place in my dreams, again and again."

Case 2. Mrs. M. T., age 38, executive secretary. Migraine headaches. Migraine in mother's family.

"There are two recurrent dreams which impressed me enough to remember quite vividly. The first, and most frequent, is one in which I am suddenly transplanted, as it were, from the confusion of an ordinary dream to a lovely country-lane scene—beautiful old trees, an old stone wall, sometimes a tiny curved stone bridge appears over a small, clear, peaceful, little brook. There are wild flowers everywhere, and lovely, puffy white clouds in an indescribably blue sky. I am usually standing in the shade just at the side of the lane, drinking in the beauty of the scene before me. I am always alone, but sometimes I sense rather than actually see, a beautiful little house which seems to be just over a small hill in the distance . . . While I'm gazing on the scene I *know* I have seen it all before, but it always seems so calm and peaceful, and I also know it just can't last! My joy in the beauty of the spot is always mixed with a feeling of sadness for this reason. I usually wake up the moment the scene disappears, and feel quite frustrated that I was unable to retain it any longer, but also feel grateful for even such a brief moment of beauty and peace.

"The second dream has occurred only twice that I can recall, but the first time it was so very vivid that I can still almost see it in minute detail—it was suddenly before me in the most gorgeous and wonderful colors, and was a scene of what I *know* would be an artists' conception of a quaint Indian village, as it seemed to be almost a huge canvas with a scene painted on it at first, but as I gazed in awe at the colors, it took on a dimensional value also. It was as though I were standing on a hill overlooking a great white plain with a beautiful purple mountain behind it and a lovely beach with beautiful, soft waves breaking on it, and in between the mountain and the sea were a great many Indian tepees all gayly decorated with amazing abstract designs—all of the colors were bright and gay without being at all gaudy, and everything stood out very clearly as though in a very bright sunlight. I felt that I had seen it all before . . . I had a strange feeling of excitement as I gazed at the scene for what seemed a very long time—beautiful color always excites me, and these colors were literally "out of this world!"—but I suddenly realized that the whole thing was completely deserted and that I was *the only living thing* within *hundreds* of miles! I began to feel horrified at this thought, and actually felt chill, and the whole thing suddenly disappeared.

"I awoke and still 'saw' the whole scene very clearly, colors and all, and it has remained just as vivid in my mind ever since—for days afterward I found myself recalling the scene and wondering why it was all so deserted and lonely, and at the same time, so beautiful.

"The same scene reappeared a year or so later except that this time the colors were dull as though seen in the twilight and the whole thing seemed to disappear as though behind a heavy curtain. I awoke very disappointed over the fact that the colors had changed so, and that the whole scene seemed so dull compared to the first time. I still had an overwhelming feeling of the loneliness of the place. . .

" . . . I invariably carry over the mood of my dreams to my wakeful moments—it may last only a few minutes or quite a while, or suddenly recur during the following days . . . Nearly all the dreams seem so *very* real. I sometimes have difficulty shaking them off, or distinguishing between dreams and reality."

Dream Pattern #3: The Waking Dream. This recurrent dream might technically be called a hallucination, since it takes place *after the patient wakens from a nightmare.* However, my patients, who are familiar with the typical hallucinations of migraine, insist that these are *"dreams* experienced just after awakening." They maintain they are "different" from hallucinations.

The waking dream appears to occur most commonly in childhood, although some cases report its first appearance in late adolescence or in adult years.

Case 1. Mr. A. T., age 48, factory operator and owner. Has classic migraine headaches.

"The recurring dream hounded me, I use the term advisedly, from the age of five until the age of ten. . .

"Night after night I awoke from a nightmare. I would awake with a startled awareness, 'that something is after me.' It was. Right there, at the opposite corner of my bed stood a tall shapeless apparition, shrouded in white, staring at me forebodingly. I would lie motionless. My heart racing, shivering from fright and coldness . . .

"Then slowly 'it' would commence, to me, the agonizing march toward my bed. Heart-splintering

step after heart-splintering step. The urge to cry out was excruciating, but the vocal cord as well as every other muscle in my body was paralyzed from fear. But when 'it' finally reached my bed, and I was resigned to my fate, 'it' suddenly diffused in the air. Then 'it' gradually reformed itself and assumed 'its' previous position, at the opposite corner of my bed, for a repeat performance. And so it went, till the first rays of gray would dissipate the complete darkness in the room.

"The days following those ghastly experiences were spent half in living down the horror which lingered on for hours . . .

". . . when I reached the age of 10 . . . the phantasies gradually diminished in frequency until they stopped completely."

Case 2. Miss B. C., age 30, expert stenographer. Has migraine headaches.

"About (18 years old) I was sleeping one night when I was awakened by a feeling that some terrible and evil form was inches away, surrounding and engulfing me. The pressure from this form was fiendish and suffocating. I have always likened this feeling to (the old tales of) the Devil, because it has been, in its *recurring* infrequency, something indescribable which has not the shape or form of a human . . . The feeling of horror lasts into the day."

Case 3. Mr. D. M., age 38, real estate broker. Family history of migraine. Patient had recurrent attacks of extreme exhaustion and occasional migraine headaches.

"I had a dream. I don't quite remember . . . something thrust me upright, jackknifing me. I was sitting in my bed half doubled up . . . Something wrenched my body violently to the right, so violently that I felt pain. In a shutter-clicking thousandth of an instant, I wakened. I saw the shape beside my bed, between my bed and my desk. It had a cloudy, grayish, hunched-up appearance. It had thickness and substance because I couldn't see through it. I was afraid of it. Then it was gone and I could see the desk with the papers and book on it and I could see the swivel chair in front of the desk. I remember falling back on my pillow exhausted and saying to no one in particular, 'I'm sorry, I'm sorry. I had a nightmare.'

" . . . I have had this dream repeated several times during the past years, though never with quite such violent effect. Yet, I now remember, the three elements were always present. Something brought me upright in bed. Something twisted me to the right. And I saw the shape."

In the course of taking histories I have come across one other dream pattern; because it is not as common as those above, I do not use it in making diagnoses. However, its incidence is frequent enough to warrant mention here. Some patients experience it while awake, others, only while they are asleep.

This is a falling dream—but it differs from other falling dreams in that the dreamer floats gently down a *"long, dark funnel with corrugated sides,"* landing with a slow-motion bounce at the bottom. A few patients describe the "funnel" as "spiralling." They have no fear with this dream, only a sense of "mild amazement."

Elsewhere (3) I have mentioned the fact that Lewis Carroll (Charles Lutwidge Dodgson), who wrote *Alice In Wonderland,* was a migrainoid, and that *Alice's* adventures consist mainly of migraine experiences. The most effective description of my patients' falling dream can be read at the beginning of Alice's story, when she falls down a dark rabbit hole "lined with shelves!"

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SOME PSYCHOSOMATIC CONSIDERATIONS IN DYSTROPHIA MYOTONICA*

Report of a Case

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Dystrophia myotonica, or myotonia atrophica, is a well differentiated neurologic entity consisting of a characteristic motoneuronic, ocular, and glandular disorder. The "classical" distinguishing symptoms are myotonia, muscular atrophy of characteristic distribution, cataract, testicular involution, and frontal baldness. Though the major symptom, the muscular myotonic reaction, is said to "increase under the influence of emotion or of cold" (4), opinion has varied as to the central—or fortuitous—importance of psychologic manifestations in patients with this disorder. Thus Kinnier-Wilson in his textbook of neurology states (4): "The significance of psychical anomalies has been overrated; feeblemindedness or mental deterioration is fortuitous, while irascibility, suspicion, or untruthfulness is not perhaps unnatural when family secrets are being laid bare."

Nonetheless, a number of authors have persistently called attention to mental and emotional symptoms, recurrent and in a general way uniform, through a number of studied series and family groups, that perhaps indicate a more than accidental coincidence of somatic and psychic dysfunction. These manifestations in the "nervous and mental" sphere have been of three major kinds. The first described had to do with impaired intelligence and intellectual function (2, 3, 5, 7, 11). Fischer (3), in 1920, spoke of "impaired mental development" as being a then already well known concomitant of this disability. Maas and Paterson (5) separated two types of intellectual defects, one group with an innately impaired intelligence and another that showed distinct evidence of intellectual deterioration from an original normal level. Billings and Ravin (2) subjected their patients to psychologic test batteries and on the Stanford-Binet test found an I.Q. range of 67-107, with an average of 80. Thomasen (11), in a study of 94 patients, found that only 20 "preserved a fair degree of intelligence." The rest showed varying degrees of intellectual defect, 9 of them being frank mental defectives; 5 of these were in institutions for the feebleminded. Rittmeister (7) concluded that patients with these mental effects were "not simply debile persons or reduced in intelligence, but they showed a peculiar mixture of organic, spiritual, and mental deformity as it occurs in a number of heredodegenerative diseases."

The second major focus of investigation in the field of "nervous and mental" phenomena concomitant with the somatic dysfunction of myotonia atrophica, has been the attempted delineation of distinguishing character traits and behavior patterns of these patients (2, 3, 5, 7, 9, 10, 11.) Traits recurrently observed were apathy, indifference, indolence, moody suspiciousness, ill-humored complaining and a chronically pervasive depressiveness (3, 7, 9, 10, 11). Stolba (9) described one attempted suicide. Maas and Paterson (5) spoke however of a characteristic temperament that is "persistently and almost morbidly cheerful, with mild grandiosity . . . usually somewhat condescending," although they too emphasized lack of drive and initiative. Billings and Ravin (2) undertook the most extensive personality inventories, including both clinical evaluation and Rohrschach testing in a search for specific personality configurations. Unlike

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the other authors, they found no special pattern of reactivity and behavior and stated that the patients "do not conform to any particular basic type of personality organization."

The third discrete manifestation of "nervous and mental" components of this neurologic disease process has been a number of observations of specific psychiatric nosologic categories, usually psychotic in nature, appearing in patients with myotonia atrophica (1, 3, 5, 10). These have included such diverse entities as schizophrenic, paranoid, manic-depressive, epileptic with mental deterioration, hysteric fugue states, and severe impulse neuroses.

Though many of these reports in the literature point to varied aspects of the possible interrelatedness of the mental processes and the motoneuronic disability in this disease, there have been no longitudinal investigations reported of the dynamics of mental functioning in a patient with well defined dystrophia myotonica. Having had the opportunity, albeit a a brief one, to undertake such a psychodynamic study in a patient with this illness we shall present this case and discuss some of its possible theoretical implications.

Case Report

The patient is a 44-year-old, married white man, a veteran of World War II. He was first admitted to Winter VA Hospital in May 1951, complaining of muscle weakness and "cramping," particularly of the hands, feet, and toes, with delayed ability to relax after flexion. He first noted this condition eight years earlier, when he was in the Army, under conditions of exposure to cold. A doctor in the Army told him that it could have come from lying around on maneuvers in the cold and wet. At the same time he noted trouble with his vision, which he believed to be due to a foreign body which might have "entered" one of his eyes at some time in the past. A diagnosis of dystrophia myotonica was made and the patient given a C.D.D. in January 1945, with a pension for a 30 per cent disability. In the ensuing seven years the condition has persisted without much change—moderately disabling but apparently nonprogressive. The patient was admitted to Winter VA Hospital for re-evaluation of the basis of his pension claim, concerning which some question had been raised at another VA Hospital where he had sought treatment for his failing vision.

On admission the patient was a tall, poorly nourished male of asthenic make-up, appearing somewhat older that his stated age. He was partly bald and his face showed the typical "myopathic facies" with atrophy of the temporal and masseter muscles especially and a consequently "sad" facial expression. There was a striking wasting of the neck muscles, especially the sternocleidomastoids and his neck inclined foreward slightly, giving the head and neck a mild swanlike appearance. His hands showed undue prominence of the "snuff box" area. When he flexed his hands and fingers, he was unable to relax the contraction without using the other hand to extend the flexed fingers. This difficulty was more marked in the right hand than in the left. The right hand grip was also somewhat weaker than the left. The same condition, though in lesser degree was present in the toes. In spite of his difficulty and apparent pain in relaxing spastic muscles, he insisted on displaying the defect, even when not asked, and pulled his socks off to show the cramps in the toes, all the while protesting that he hated to do this. He complained that doctors did not appreciate the full extent of his illness; he wished the examiner could see him in cold weather and emphasized his greater difficulty at those times. He had bilateral cataracts, mature in the left eye and early in the right eye. Otherwise, the general physical examination was within normal limits.

On the basis of the characteristic myotonic reaction, the muscle atrophy in "classical" distribution, and the endocrine defects (cataracts, baldness), the diagnosis of dystrophia myotonica was confirmed. A course of quinine therapy, 10 gr. q.i.d., was instituted though he had experienced but little help from this medication in the past. He had "grown used" to his disability and did not feel that his limited functioning was much improved by quinine or any other medicament. He had "no confidence in quinine." It was "no damned good."

Psychiatric Anamnesis. The patient, born in 1907 to a Missouri family, is the eldest of 3 children, the other 2 being girls. The parental home was a rigid and moralistic one with an emphasis on punctual church and Sunday school attendance. Smoking and drinking were frowned upon. Discipline was not enforced by physical punishment. Instead, the mother would characteristically trap the patient into confessions of wrong-doing, and then she would say, "I never thought you would do this to me—your own mother." The father was a hard-working farmer, described as a man of easy disposition who presumably enforced standards of hard work by example alone. However, this past year, though without financial resources, the patient and his wife moved away from the father's home and the patient hints that this action was provoked by the father's difficult, irascible temperament. The father is still living, though retired and in poor health. The mother died in 1940 of a broken hip and pneumonia. Of the two sisters, the nearer in age, (just 19 months younger than the patient) died in 1945 of rheumatic heart disease and a "mental breakdown." The other sister, though now well, was ill over the past few winters with a condition at first thought to be the same as that of the patient, but it turned out to be "just plain arthritis."

As a youngster, the patient was brought up on a dairy farm where the entire emphasis was on atten-

tion to work, and speed and competence in the performance of chores. The principle job was the milking of 70 cows twice daily. The patient stubbornly resented this burden, and the nickname "Holstein" bestowed by his schoolfellows. He was always "a little fellow—light." He weighed but 90 pounds when he graduated from grade school. By contrast, his father was over six feet tall and weighed over 200 pounds. There were three hired hands—"all bruisers." The patient could never keep up with them or his father in milking. The patient described in detail how he could never do better than ten, and then only easy ones, whereas his father could milk 14 cows in an hour, "hard ones and easy ones." When he graduated from high school, his weight was up to "135 only. I had the height but never had the weight." Yet despite an opportunity to go on to college, the patient refused, chose instead to stay on the farm working for his father, and maintaining the unequal struggle.

The patient's life in school, like that on the farm at home, centered on intense competitive endeaver and constant comparison of himself with his larger schoolmates. He participated with fair success in track and field events where "my height helped me." He went out for pitcher on the baseball team though his "arm could only last four or five innings." He would have liked to have played football but his parents forbade it. "I was too light anyway." All his life he had successfully avoided direct physical encounters except for one "harmless" episode in which he fought with a drunk who had made remarks about a girl. The patient stated proudly that he "knocked him out" though he weight but 140 pounds and his opponent was "over 200," and then immediately offered the assurance that this was the only fight in his life.

The patient's preoccupation with his weight, with his comparative strength and potency, and his need both to compete and to withdraw from competition have persisted in all areas of his adult life. Always the measure of success has remained that of adequacy in milking the hated cows. In 1933 the patient's father lost his farm by bank foreclosure. He had become ill with diabetes, had "lost weight," could no longer "keep up" with the demands of the work. The patient took over another farm with a smaller herd of 25 to 30 cows and one hired hand. The hired man was deliberately chosen as one "who couldn't milk any faster than me." The burden of this smaller farm grew too heavy and the patient soon drifted through several odd jobs until his induction into the Army in November 1943.

The patient dates the onset of his illness to his first winter in the Army, lying on the cold wet ground during maneuvers. First he noted difficulty in saluting which caused him embarrassment. His fingers unbent slowly and with effort. Then he found that he could not dig trenches. He reported on sick call and after a series of hospitalizations in the Army, with extended neurologic workups, a diagnosis of dystrophia myotonica was made. After 14 months of service, he was given a CDD with a 30 per cent disability pension. Since then the patient has been constantly handicapped. He has lived mainly on his pension, now up to 50 per cent. He has tried various jobs; greens keeper at a golf course, bartender, construction worker. All of them have required manual labor, often in the cold or wet and have proved too much.

In 1947, the patient married. He had met his wife the year before and she "seemed all right" but he has "had bad luck with her." Shortly after their marriage she came down with an open case of pulmonary tuberculosis and spent 18 months in a sanatorium. Since her return home she "has been supposed to rest," and not even attempt house work. The two live on the patient's pension. Toward his illness, he shows an apathetic resignation. He feels helpless and hopeless. "There is nothing that can be done for me." He complains bitterly of cold weather or cold water, both of which accentuate his difficulties. He is chronically moderately depressed. Life and work are now "a whole lot of nothing." A major ironic satisfaction is that now no one can expect him to do any milking. With a laugh, he states that "one thing is sure," he "just won't be able to milk those damned cows anymore." The rhythmic milking motion of clenching and unclenching his fist is the movement that is most inhibited.

Discussion

As suggested in a previous communication (12), the point of departure in the study of postulated psychosomatic interrelationships should be in clarification of the frames of reference from which these investigations must derive. Depending on the conceptual frame of reference within which we ask our questions of the biologic organism, we emerge with a set of answers limited to the pathology demonstrable within that frame of reference. That is, using physiologic methods of investigation we derive a picture of pathophysiologic dysfunction. Using psychologic methods, we get a picture of psychic drives and stresses, the unique personality configuration of the individual. In terms of the investigation of the functioning of the total organism, each frame of reference can yield but partial answers, germane to its own questions. The organism itself remains always "psychophysically neutral" (8). Both physiologic and psychologic frames of reference, because they yield complementary yet separate sets of partial data derived from the same functioning organism, can be studied side by side and any parallelism or divergence in their data allowed to emerge. With this point of view we can examine two separate sets of data that emerge upon study of this case, recognizing explicitly

the brevity of the study and hence the tentativeness of the conclusions that can be derived.

The patient's lifelong behavior and adjustment has been one of intense competitive striving and comparison of himself against the standards and demands for more performance fostered by his world and accepted within himself. His father, by example, set standards of hard work that the patient has never felt able to meet. The chief criterion of adequacy was speed and competence in the performance of chores, especially the milking of 70 cows requiring skill and strength in the rhythmic opening and closing of the fists. The patient was always the little fellow (doomed to frustration); the others (father, hired hands, schoolmates) were big fellows. Constantly comparing his weight, his strength, his endurance, his potency, with theirs, constantly choosing to keep up the unequal struggle (as when he declined to go to college); constantly needing both to compete and to withdraw from the competition, the patient continually kept before him as the hated and desired symbol of achievement, speed and endurance in milking cows. At no point could he, without guilt, and fear of defeat, relax the hostile tenacity of his struggle against the authority and achievement vested in the "big guys"—the father imago.

At the age of 36, while in the Army, a specific neuromuscular difficulty became manifest, that led to a diagnosis of dystrophia myotonica. Significantly, the first somatic symptom (which was difficulty in clenching and relaxing his fists) revealed itself as a specific bar to saluting (rather than in other areas—for example—as in eating).

The chief symptom all through the illness has been the difficulty in clenching and opening the fist. A somatic disability was now present that imposed a structural limitation, which in terms of its psychologic meaning could be viewed as the "freezing" of the musculature in the striving for performance of the forever unmastered task. That is, the symptom represented the structural fixation of a particular somatic posturing that reflected the underlying conflict-laden striving, like the "muscular armor" which Reich (6) has pointed to as the frequently observed somatic reflection of "character armor." By "character armor" he refers to the system of psychologic defenses which serve as protection against feelings of anxiety.

Simultaneously the symptom—in compromise fashion—represented also defeat and punishment. The hands were stiff and useless. Secondarily, some measure of neurotic gain could accrue. The pressure had gone out of the unequal struggle. The patient could retire on his pension and his family, and could now with justification, plead inability to "milk those damn cows anymore." He could even exhibit his disability and resign apathetically from the struggle. Life and work are openly "a whole lot of nothing."

Thus, from within two different frames of reference (psychologic and physiologic) striking points of convergence of data emerge. The sequence of muscular movements most highly cathected with both wishful striving and fear are the ones most specifically barred by the nature of the structural limitation imposed by the somatic disease. The "muscular armor," the somatic reflection of the "character armor," has become structurally fixed as it were in a continued expression of the underlying psychologic struggle. This association *can* be viewed as a striking but accidental concordance of data collected within different frames of reference. Speculatively, however, we can examine the possibile implications suggested by this convergence. Certainly the compromise solution of the psychic conflicts seems identical with the structural limitations imposed by the organic disease. This cannot be explained, however, in terms of a given constellation of unconscious conflicts and psychologic defensive needs "leading to" or "causing" an eventual resolution via a specific neurologic disease entity, dystrophia myotonica. Time and causality sequences cannot be here delineated in unilinear fashion. Rather, the psychic compromise formations (symptoms) and the specific somatic disability are varying but at the same time strikingly interlocked manifestations of the same functioning organism attempting to maintain its integrity amidst the interplay of internal and external stresses. The problem may perhaps be more meaningfully posed in terms of the inevitability (retrospectively reconstructed) of processes within an organism that reflect the interaction of the original (undifferentiated) constitution-

ally endowed propensities with the vicissitudes of experiential stresses. This interaction, over a time continuum, determines the total complexity of organismic functioning and adaptability. At any point in time, cross-sectional psychologic and phsiologic studies will yield data, whether of "sickness" or "health," unique to that individual, and meaningfully rather than accidentally interrelated as a natural consequence of the common origin. With this conceptual framework we have been able to view the psychologic data derived from 2 patients, with widely disparate somatic disease syndromes, dystrophia myotonica and Addison's disease (12), as of possibly significant rather than merely accidental interest to a study of the interrelatedness of total dysfunctioning of the individual.

Summary

A conjoined somatic and psychiatric study of a patient with dystrophia myotonica is reported and the literature on the subject of the mental and emotional concomitants of this organic disease process is reviewed. A relatedness has been suggested between the psychologic organization and its characteristic defenses evolved to meet life's stresses, on the one hand, and the somatic symptomatology imposed by the structural defect, on the other. Some further extrapolations from these data are offered. A similar correlative study (derived from the same theoretic framework) has been previously reported in a patient suffering from Addison's disease.

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PRELIMINARY EVALUATION OF NOVALDIN AND SERUM-ALBUMIN IN THE THERAPY OF PROTRACTED INSULIN COMA

GRACE K. JAMESON, M.D., AND HAMILTON FORD, M.D.

Since the publication of Sikes' Novaldin-serum albumin method of treating protracted insulin coma (3), the authors have used it in 36 patients with extremely promising results. The salt-poor concentrated human albumin used in this study has been provided through the generosity of Dr. S. T. Gibson, Associate Medical Director, Blood Program, American National Red Cross. The series consists of 34 delayed awakenings from coma in 33 patients, and three severe furors which followed attempted termination with intravenous glucose. One patient had two delayed awakenings.

Termination of coma is routinely accomplished with 50 cc. of 50 per cent glucose. If the patient fails to respond within two minutes, he receives a second such injection, and if not awake within the next two minutes, he is given 50 cc. 50 per cent glucose with 200 mg. thiamine. Failure to awaken promptly after this third injection, whether or not hyperpnea, hyperpyrexia, restlessness, or evidence of deepening coma have yet appeared, constitutes our criterion for the diagnosis of delayed awakening, or potentially irreversible coma. This state is recognizable 5 to 8 minutes from the time the first injection is begun.

Following Sikes' method, patients who have not responded after the 150 cc. glucose and thiamine are given 2 cc. Novaldin i.v. (Winthrop-Stearns), followed by 20 cc. salt-poor human albumin through the same needle. Patients who fail to improve markedly within the ensuing 15 minutes receive a second injection of albumin 15 to 30 minutes after the first. Where hyperpyrexia is present, sheets soaked in ice water are applied to the entire body surface as rapidly as possible, and oxygen is administered by mask if cyanosis, hyperpnea, or any respiratory difficulty occurs. Infusions of 10 per cent glucose in water or saline, additional 50 per cent glucose, and blood transfusions are also used in severe reactions not responding fairly promptly. We do not tube-feed our patients until the gag and cough reflexes have returned, because of previous unhappy experiences with emesis and aspiration of the tube feeding in deeply comatose patients. The delayed reaction is considered to be terminated at the point when the patient is able to drink. However, improvement is evident before this point is reached, in that restlessness subsides, normal eye movements and pupillary reactions return, and the patient begins reacting to painful stimuli.

A summary of our cases tends to confirm Sikes' findings, as follows:

1. There were 23 reactions in 22 patients, who responded dramatically within 15 to 20 minutes after injection of the Novaldin and albumin. All of these patients were fully awake within one hour after termination was started, the average being 30 to 40 minutes.

2. Three patients with severe furor states after termination calmed down and became completely cooperative within 10 to 15 minutes after injection of 2 cc. Novaldin and 20 cc. salt-poor concentrated human albumin. All had failed to respond to additional glucose and thiamine. Perhaps response might have been due to the glucose taking effect slowly, but we are unwilling to take the risk of waiting to see.

3. There were seven patients in whom coma persisted for one to four hours before complete awakening, requiring more energetic treatment than any of the first group. A breakdown of this group is of interest, however, in that four of these patients were diagnosed and treated far too slowly, with intervals as long as 30 minutes elapsing from the time the first glucose was administered until the first dose of Novaldin and albumin was given. In the other three patients, although complete awakening did not occur for two to three hours, there had been a great deal of improvement within one hour, in that all had become afebrile and restlessness had ceased.

4. There were three patients who required

energetic treatment for 4 to 10 hours before complete awakening occurred. Two of these were in our first 12 patients, and there was some delay in treatment, especially in treating hyperpyrexia with cold sheets, as we were somewhat naively waiting to see what the Novaldin-albumin treatment would accomplish. The third patient turned out to have an undiagnosed convulsive tendency. This man was a somewhat mentally defective paranoid psychotic who went into status epilepticus after termination of his initial insulin coma with glucose. It was difficult to tell whether he was having a prolonged secondary insulin reaction or not, since the seizures occurred so rapidly that he may never have regained consciousness from them. He showed no apparent response to the Novaldin and albumin, going into left heart failure 40 minutes after receiving it. He was digitalized with cedilanid, given oxygen continuously, and restricted intravenous fluids were administered after the pulmonary edema subsided. It is probable that he would have been a severe management problem with or without Novaldin and albumin.

5. One fatality occurred, also early in the present series of patients. This patient had sustained some brain damage during the preceding 42 insulin comas; she had had several episodes of respiratory difficulty and convulsions during her previous treatment and probably should not have been continued on insulin coma therapy. She never showed any evidence of improving despite two injections of Novaldin and albumin, 500 cc. whole blood, and intravenous fluids; she was digitalized when pulmonary edema developed after about four hours of coma. Her temperature remained elevated at 105° rectally, despite all attempts to bring it down, and it was 108° for a short period of time. She died five hours after the first injection of glucose.

Our experience with our last 15 patients is in complete agreement with Sikes' contention that therapy must be instituted as soon as diagnosis is possible, that is, within 5 to 10 minutes from the time of beginning attempts at termination. All of these cases were diagnosed within five minutes, and had received Novaldin and albumin within seven to eight minutes. Each of these patients was fully awake within an hour, or afebrile and quiet by the end of that time, and none required treatment longer than three hours. The majority of these patients were never febrile, or had temperature elevation up to 103° for only a few minutes. Those patients in whom institution of therapy was delayed for 15 to 30 minutes had far more severe reactions, with temperatures as high as 105° axillary, and were far more critically ill for periods of two to ten hours.

Discussion

We have made no attempt to explain the mode of action of these drugs in reversing potentially irreversible coma; the hypothesis that Novaldin, found by Risak (2) to increase meningeal permeability, may render the blood-brain barrier more permeable to salt-poor albumin, which then may act to reduce cerebral edema, seems attractive to us. As clinicians, our interest has centered on attempting to confirm or deny the value of Sikes' method of treatment. It would appear from our experience thus far that prompt awakening from the coma can be expected if the treatment is instituted immediately, and if total reliance is not placed on Novaldin and albumin. Our present belief is that hyperpyrexia should be combated immediately with sheets dipped in ice water, or water and alcohol, and that oxygen should be administered to all patients with any respiratory distress, cyanosis, fever, or tachycardia (140 /min. and higher usually). Furthermore, we feel that no great amount of intravenous fluids should be given until the heart and respiratory rates slow down, because of the risk of cardiac failure and pulmonary edema. For this reason we give additional injections of 50 per cent glucose at intervals throughout the coma until the heart and respiratory rates slow and temperature falls. We never give any oral or tube feedings until the cough and gag reflexes have returned.

During the past 18 months we have felt increasingly optimistic that we have a method of treatment we can apply with some confidence that the patient will awaken shortly; it may be that this method will reduce markedly the risk of insulin coma therapy.

Summary and Conclusions

An attempt has been made to confirm or deny the value of Novaldin-serum albumin

treatment in the therapy of protracted insulin coma. A series of 36 patients is presented, one of whom had two such reactions. In 29 instances, 3 furors and 26 protracted comas, response to therapy was evident within 15 to 20 minutes, and all but three of these were completely awake by the end of one hour. Of six patients in whom institution of therapy was delayed from 15 to 30 minutes, full awakening occurred at the end of one to four hours in four, and 4 to 10 hours in two. One epileptic who went into status after termination of his coma, and was incorrectly diagnosed as a secondary insulin reaction with protracted coma, is included in the series, although he showed no response to the treatment; and there was one fatality in a patient who was known to be a poor treatment risk because of previous convulsions and anoxia during insulin comas. No valid statistical conclusions can be drawn, and none are presented, but it appears likely, on the basis of present experience, that this method of treatment does have value.

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OBSERVATIONS ON THE EFFECT OF ELECTROSHOCK THERAPY IN TWO NEUROLOGICAL CASES

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Occasionally in the course of private practice the neuropsychiatrist is confronted with the decision to recommend electroshock therapy for severe mental depression in cases complicated by organic disease of the central nervous system. The author, having met this situation several times and having administered electroshock, made certain observations which are the subject of this paper. Two of the cases are described because they produced interesting sequelae.

Case. 1. The author was called on August 19, 1950, to see a 72-year-old Jewish woman, because she had prolonged crying spells and bouts of screaming and restlessness lasting many hours. Apparently, only exhaustion stopped these attacks since sedatives had little effect.

The patient had been an active, alert and dominating figure most of her life. About two years ago she had developed progressive paralysis of both lower extremities, coincidental with the onset of a severe aplastic anemia, so that she became bedridden. She received Vitamin B12 with correction of the anemia, but without halt to the progression of the paraplegia. Contractures developed until she was almost in a fetail position. There was no ability to move any portion of the lower extremities. She also became incontinent of urine and feces.

Neurological examination revealed a pale atropric tongue, sclerotic retinal and radial vessels, complete loss of voluntary movement of the lower extremities including toes, extreme clasp-knife rigidity of lower extremities, bilateral adducation spasm, brisk dorisflexion on plantar stimulation of each foot, complete absence of vibratory and position sense and some diminution in pain and touch below D12. Deep reflexes could not be elicited in the lower extremities. Abdominal reflexes were absent. Mental examination revealed deep depression, a feeling of abandonment and alternating disorientation and orientation. She was extremely alert in sensing trends and situations when oriented.

A course of nine electroshock treatments with Reiter #1 machine and bifronto-temporal application was instituted at the rate of twice a week. During the actual stimulation both lower extremities were completely extended with plantar flexion of both feet and all toes. On cessation of stimulation the lower extremities did not return to their contracted position. Babinski responses were not as brisk as before treatment. The nurse noted that the lower extremities were looser and easily kept extended. This was confirmed on clinical examination. As treatment progressed it was noted that the patient was able to move her toes voluntarily and to a lesser extent she could move her legs weakly. Involuntary movements of the extremities, never present before, developed. Blood pressure rose from 160/100 to 220/120, dropping back to 160/100 two months after treatment. A curious convulsive response to the electroshock was also noted in that the grand mal lasted 2 to 3 times as long as in other cases. Usually with the Reiter #1 machine 45 seconds of stimulation produces a convulsion ending 60 seconds from start of stimulation. Her convulsions lasted 120 to 180 seconds. According to the last reports the mental depression is minimal, interest has returned and screaming, yelling and overactivity ceased. Her lower extremities have remained much more flexible, contractures have not returned to date and clumsy, uncontrolled voluntary movement is present. Bilateral knee jerks are now elicited for the first time.

Diagnosis. Thrombosis of posterior spinal arteries, paraplegia (postero-lateral syndrome).

Case 2. A 65-year-old Italian male, three months before the initial examination on September 11, 1950, exhibited a slowly-progressive paralysis of the right arm and leg. He had shown no response to vasodilators. The author was called to see him because the patient had become morose, depressed and suicidal. Neurological examination revealed a right-sided hemiplegia, right central facial weakness, hyperreflxia, much greater on the right, right sided hyteronus (lead pipe rigidity), brisk dorsiflection on right plantar stimulation, poor plantar response on left, sustained right ankle clonus and absent right abdominal reflexes. Eyegrounds showed tortuous thin retinal vessels. Blood pressure was 180/100. Mental examination showed deep depression, hopelessness and suicidal threats. Every few minutes he exhibited the following picture of involuntary crying: the eyes were closed, face reddened, corners of the mouth retracted, mouth open with no sound issuing, except a slight expiratory hiss. This attitude would persist for about a minute and cease as suddenly as it started. Sensorium was intact.

At the insistence of the family a course of five electroshock treatments, with bifronto-temporal application, was given at twice weekly intervals. During each convulsion the patient's right arm became extended instead of flexed upon the chest as usually occurs. The left arm was flexed and the lower extremities were equally extended in usual fashion. Immediately after each convulsion Babinski could not be obtained but was elicited 20 minutes later.

It was noted after the first treatment that the lead pipe rigidity had been replaced by a very mild cog-wheel type. Before the second treatment he was able to make clumsy, voluntary movements of the right arm, forearm, hand, fingers, thigh, leg, foot and toes. The involuntary crying ceased. These effects have remained to the present day. The patient exhibits some slight depression and refuses to exercise or get out of bed, although he now has considerable voluntary movement of the right-sided extremities. Right Babinski is still present.

Diagnosis. Thrombosis of left lenticulo-striate artery, right hemiplegia.

Discussion

The neurological sequelae noted during and persisting after electroshock therapy in the above cases were: 1) decrease in spasticity; 2) increase in voluntary movement, possibly as the result of decreased spasticity.

These findings suggest that the effect of the electro-convulsive therapy (ECT) was to activate undamaged or reserve areas of the central nervous system to: 1) inhibit the function of released lower centers; 2) take over the functions of the damaged regions. The net result would be the reestablishment of higher-level dominance by opening up alternate neural pathways to bypass the damaged areas.

The possible factors underlying activation may be: 1) lowered threshold levels resulting from the electro-convulsive-therapy; 2) stimulation of area 4S by the bifronto-temporal passage of courrent.

The hypothesis that convulsive therapy tended to reestablish the dominance of higher centers in the cases cited may well be applied to convulsive states and shock therapy of psychoses. In symptomatic epilepsy the constant progressive or recurrent interference with local brain function may set off a compensatory mechanism in an attempt to unlock alternate pathways and reestablish higher-level dominance. In idiopathic epilepsy similar mechanisms may be tripped off automatically to reestablish the dominance of areas showing a tendency toward lowered function. In the psychoses there may be a tendency toward autonomous repetitive unintegrated functioning with failure of compensatory mechanisms. Artificial application of convulsive therapy then helps to reestablish higher level control and integration by opening up blocked-off channels of communication.

The observations made in these cases and the hypothesis set forth indicate that there may be a wider use for ECT in neurological conditions.

Summary

1. One case each of left lenticulo-striate artery thrombosis with right hemiplegia and posterior spinal artery thrombosis with paraplegia showed decreased spasticity and increased voluntary movement during and after electroshock therapy.

2. The results suggested that ECT, by opening up new neural pathways to take over the functions of damaged areas and to inhibit the effect of released lower centers, reestablished the dominance of higher centers in these cases.

3. The implication of this hypothesis for convulsive states and shock therapy of the psychoses was discussed.

4. ECT might find application in the treatment of neurological conditions, particularly those with spasticity.

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A CASE OF RECURRENT INTRACRANIAL MENINGIOMA TREATED BY CHEMOTHERAPY

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The purpose of this case report is to present a method of treatment which has been tried on a patient with recurrent intracranial meningioma. It is felt that this method may be applied to other cases of recurrent intracranial neoplasms which have not responded to the usual methods of attack. It is not the intention of the writer to propose that this method should be used in lieu of the standard methods. Rather, it is hoped that sufficient interest will be aroused so that this treatment will be tried where standard therepeutics have failed.

The routine of treatment is as follows:

0.2 gm. of Bismarsen (donated by Abbott Lab.) and 5 gamma of Piromen (donated by Travenol Lab.), a bacterial polysaccharide diluted in 3 cc. of 2 percent novocaine are injected intra-muscularly three times weekly for 20 injections. A rest period of four weeks is then given. Three courses of treatment are given with four weeks' rest in between courses. After two months' rest, another three courses of treatment should be given as outlined above.

This method was used in the following case:

F. L., female, white, age 47 years, was operated upon at Bellevue Hospital for a left temporo-parietal meningioma, which was not completely removed. The left temporo-parietal region was covered by muscle but the bone flap had not been replaced.

Some months thereafter the patient complained of recurrent headaches and pain in the incision. In May, 1948, craniotomy was performed because headache and vomiting were not controlled by any medication and because the operative area began to bulge with the increase in intracranial pressure. A great portion of the neoplasm was removed and a tantalum plate was used to repair the defect.

The patient was comfortable until September, 1949, when she began having Jacksonian attacks, involving the right upper limb and face, recurrent headaches, bouts of vomiting and periods of disorientation. Operation was performed and despite the extreme vascularity the greater part of the tumor was removed. The tantalum plate was not replaced. The patient was well with Dilantin and Phenobarbital. In the early part of January, 1953, Mrs. L. complained of headaches, vomiting, dizziness, frequent Jacksonian attacks, disorientation and violent attacks of temper without cause. Dilantin and Phenobarbital no longer controlled the epileptic episodes.

The first injection was given on January 21, 1953. After the fifth injection she felt well. There were no headaches, no Jacksonian attacks, no loss of temper and no disorientation. After 12 injections, the patient went on a 3-week vacation. During the last week of the vacation, Mrs. L. had a violent attack of temper tantrums followed by a Jacksonian attack.

On April 4, 1953, the injections were reinstituted. In May, 1953, the patient was involved in an automobile accident. That night she went into status epilepticus from which she recovered. In July, 1953, she had another epileptic attack. In August, 1953, she showed increase in proptosis of her left eye. Partial motor aphasia and proptosis had been present since the original operation in 1947.

On October 16, 1953, the injections were discontinued. On November 17, 1953, the patient had four epileptic attacks within two days. The patient was put on another course of treatment which was repeated after one month of rest. She is still taking Dilantin and Phenobarbital daily. There have been no convulsive seizures, no temper tantrums, no disorientation, and no headaches for the last six months. The proptosis has diminished somewhat and speech has improved. Mrs. L. has gained weight and feels and looks well. There is a depression at the site of operation. There has been no sign of increase in intracranial pressure since the last course of injections was finished in April, 1954.

Discussion

While the foregoing method of treatment is presented as being empirical, there is some scientific basis for it.

Gye (1) in 1949 showed that mouse tumors could be propagated. This tended to show that since transference of neoplasms was a fact, we could entertain the possibility that an infective agent may be a factor. McClintock and Friedman (2) in 1945 showed that metals and dyes could be transferred to neoplastic as well as infective tissues by the utilization of the principles of antigen and antibodies.

At the A.A.A.S. Gibsen Research conference in 1945, Oakey (3) demonstrated that in seventeen cases of malignant disease a specific bacterial polysaccharide had a lethal effect on the neoplasm in each case. This work would also tend to confirm the idea of antigen-antibody

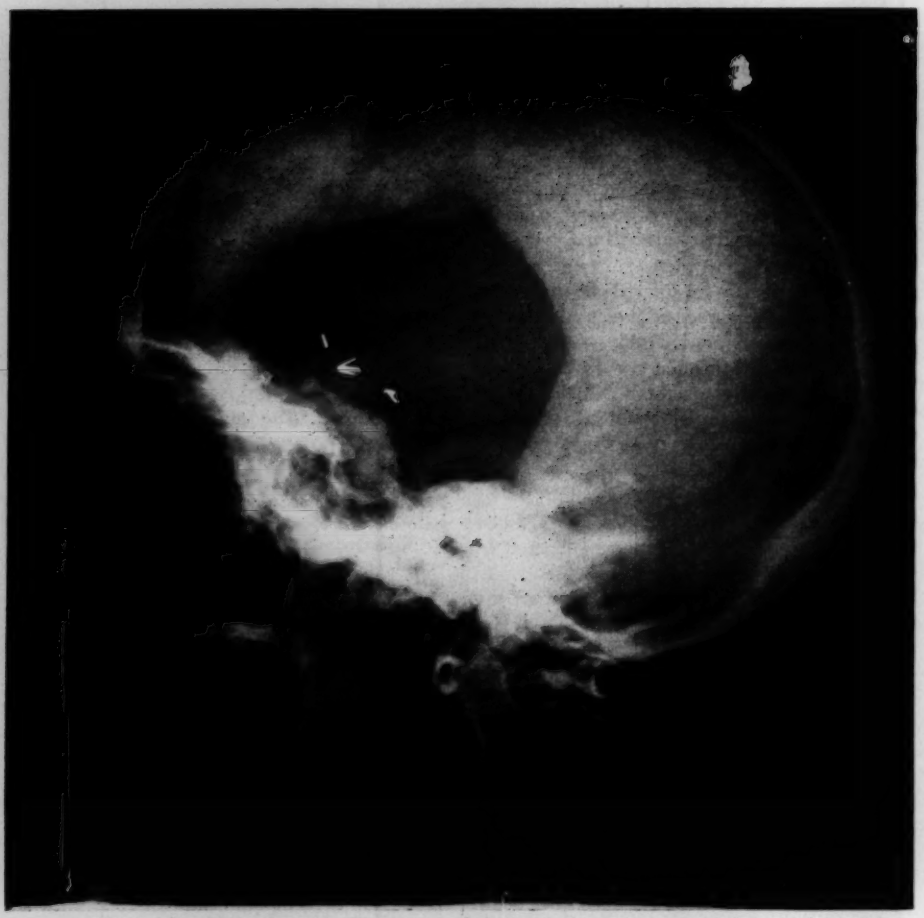

FIG. 1. X-ray taken May 21, 1954. The extent of the original neoplasm occupied most of the defects. The recurrent tumors were larger than the original. This x-ray shows local infiltration of the sphenoid wings with no other sign of recurrence.

effect in neoplastic diseases (4). Also, the work of Ludwik Gross (5) with leukemic mice makes one feel that even in leukemia an infective agent is at work. McCarty (6), Gessler (7) and Grey and Gregory (8) have shown with aid of the electron microscope that there are submicroscopic, spherical bodies which are constantly seen in malignant tissue but are not seen in benign neoplastic tissue.

The foregoing work to my mind brought forth the following possibilities:

(1) That an infective agent, possibly a virus, was a factor in malignant neoplastic disease.

(2) That transference of malignancy could take place in utero and could be delayed until the embryo reached adult life before showing itself.

(3) That there was the possibility of an antigen-antibody effect in neoplastic disease.

(4) That certain bacterial polysaccharides had shown a lethal effect on some human malignant neoplasms.

(5) That this effect may be due to an antigen-antibody reaction, or at least a hapten reaction (9).

Doyen (10) in 1917 published his findings of the beneficial effect in human malignancies of a neoplastic tissue extract and organic arsenical (leukolase). Although his work was never accepted, he claimed certain definite cures.

I took the opportunity to try an organic arsenical in combination with a bacterial polysaccharide on this patient suffering from a recurrent intracranial meningioma. Since the method was arbitrary as to the number of injections and the time of rest in between courses, there may be some adjustments as to method in the future.

It is my opinion that this treatment has shown the following to be true:

(1) The patient did not suffer from mental aberration, epilepsy, or other signs of raised intracranial pressure while she was getting the injections.

(2) the aforementioned pathological signs showed themselves only when the injections had been stopped.

(3) Although this neoplasm recurred at first in a year and a half, it is now more than 4½ years since the last operation.

(4) The patient has been clinically well since the last course of injections was started.

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TELEVISION ADDICTION AND REACTIVE APATHY

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Every new medium of mass-communication calls for a new psychological adjustment to the increased amount of food for the senses. Although it is a well known fact that television has a hypnotic and seductive action on its audience, not very much has been said concerning the alarming pathogenic action of this dream factory on special types of onlookers. In the early era of movies, we heard of "movie craziness" in children. So fully absorbed and fascinated were they by the screenworld fantasy, that for hours they were unable to come down to earth and into reality. In such dreamy states, the committing of crime became easier.

The effect of movies, radio, television, and so forth, on different human beings depends on various factors. In the first place we have to consider the whole gamut of technical inventions which have invaded our cultural habits. Secondly, we have to ask ourselves how the different senses are influenced and affected by these innovations. For instance, what are radio and television doing to the absorptive and selective capacity of our ears and eyes? Thirdly, we must analyze better the effect of too complicated and too varied images on each particular individual and his particular brain and mind. How, for example, is the adolescent affected by the constant barrage of pictures showing adult violence, stealth and sexual excitement? And lastly, we will have to make a distinction between persons who are more sensitive and impressionable—like adolescents—at an impressionable age, and those who are stable and mature.

However, apart from the scope of scientific analysis, we discover that day by day television is having a special effect on children. This demands our continual clinical interest. Concerning the value of television there are many pros and cons. We hear numerous discussions about its advantages and its evils. Yet, clinically, we are asked to determine what it does to a special person. Here we run into more and more morbid influences which have to be investigated. Many children become lazy, even apathetic, peepers.

Last year I was asked for advice in three cases of increasing mental apathy. In each case the child refused to leave the television screen. All three children were in their early adolescence. They neglected their school work and home duties. They increasingly showed the picture of a schizophrenic episode. They gradually became more negativistic, got out of bed only to look at the television screen, and apart from their television interest, showed a general apathy toward everything.

Mary X, a white girl of 15, was sent from school because she failed in all subjects. The last two years she showed a sabotaging attitude, skipped classes, or read a book during class hours. At home she showed every sign of television addiction. A psychologist had made the diagnosis of schizophrenia, based on the increasing symptoms of apathy and a lack of mental contact. First, I tended to agree with this diagnosis. But gradually I found that she was more willing to relate to me when we started to talk about the television programs. Then the girl became vivid, showed interest, told about her wishes to take part in the programs, and so forth.

It took several sessions of psychotherapy to make her better aware of the fact that she had completely surrendered to fantasy life. The process of weaning provoked much resistance, and a primitive attitude on the part of the parents did not help. It was pointed out to her that television gave her, in a cheaper and easier way, what she would otherwise have obtained from unreal fantasies, as defense against an environment she felt as hostile. The deeper causes of her flight from reality were gone into and could be explored. Gradually the girl gave up her screen sessions in order to start a new emotional investment in reality situations.

In another case, where the underlying pathology was more directed toward plain flight into fantasy, it was much more difficult to lead the patient to give up these pathogenic escape habits. I call them pathogenic because, secondarily, they fortify underlying neurotic tendencies.

In this tentative report, I do not want to enumerate all the psychological questions involved. I am aware of the fact that many parents complain about their children, and nu-

merous children about their television-crazy parents. In the cases I observed in particular, the following points could be noted:

1. That television fascination is a real addiction, that is to say, television can become a habit-forming device, the influence of which cannot be stopped without active therapeutic interference.
2. That it arouses precociously sexual and emotional turmoil, seducing children to peep again and again, though at the same time they are confused about what they see.
3. It continuously provides satisfaction for aggressive fantasies (midwestern scenes, crime scenes) with subsequent guilt feelings—since the child unconsciously tends to identify with the criminal, despite all the heroic avengers.
4. It is a stealer of time.
5. Preoccupation with television prevents active inner creativity—children and adults merely sit and watch the pseudo-world of the screen instead of confronting their own difficulties. If there is a conflict with the parents—who have no time for their youngsters—the children surrender all the more willingly to the screen. The screen talks to them, plays with them, takes them into a world of magic fantasies. For them, television takes the place of a grownup, and is forever patient. This the child translates into love.

As in all mass media, we have to be aware of the hypnotizing, seductive action of this all-penetrating form of communication. People become fascinated even when they do not want to look on. We must keep in mind that every step in personal growth needs isolation, needs inner conversation and deliberation, and a reviewing with the self. Television hampers this process and prepares the mind more easily for collectivization and cliché thinking. It persuades onlookers to think in mass-values. It intrudes into family life and cuts off the more subtle interfamilial communication.

SUMMARY

Attention has been called to the growing intrusion of television into mental life and family habits. Examples have been given of real addiction and consequent reactive apathy. The need to study the pathogenetic action of this new technical acquisition is emphasized.

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BOOK NOTES AND REVIEWS

Books received are acknowledged and given a brief description in this section. Selections serving a variety of interests will be made from these for a more extensive review, as far as space will allow.

BOOK NOTES

Hadamard, J. A Essay on the Psychology of Invention in the Mathematical Field. [Dover Publ., Inc., 1954. Pp. xiii and 145. $1.25]

This is a new printing of an inquiry into the working methods of mathematicians which was published by the Princeton University Press in 1945. It is not necessary to know any higher mathematics to follow the author. The discussion is kept merely on a descriptive psychological level. No complex ideas were used explicitly or implicitly. The text is readable and unpretentious. It does not aim at penetrating to the causes. The marked differences among the working methods of creative mathematicians, especially the main difference between the logical and the intuitive thinkers, are nevertheless clearly and convincingly presented. The author points out the great dependence of the mathematician upon his type of dominant imagery, on visual imagery or on words. We find that even in mathematics many new ideas not only precede proofs of their validity but also may require a long time before they are expressed in a satisfactory mathematical form. The author quotes approvingly the statement that "thoughts die the moment they are embodied by words". He also believes that "the sense of beauty is the moving power" of mathematical inventions. This little book helps to raise problems but does not contribute to their solution. It aids in dispelling the notion that, at least in its creative phase, mathematics is an exclusively logical and systematic procedure.

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Elliott, H. Chandler, Textbook of the Nervous System: A Foundation for Clinical Neurology [(Second Edition) Philadelphia: London, Montreal, J. B. Lippincott Co. Pp. XX + 437: 158. Illustrations and an Atlas of 50 Plates, 1954. $9.00.]

The first edition of this useful textbook was published in 1947, having been prepared for students in a concise clear way with many illustrations and other helps to orient the beginner and to enable him to grasp the subject first as a whole and then in its details. It must have been well received.

This second edition follows the same general plan of presentation, but has been enlarged by some 50 pages in the Atlas part. This addition completes a beautiful atlas with clear cut detailed illustrations and legends. The text and references have been brought up to date on all important points in the structure and function of the nervous system, and the illustrations, many in color are well integrated into the text.

All beginners in the study of the nervous system should have access to this book and specialists will find it most helpful to refresh their knowledge of these matters. It is a lot of book for the price, and an excellent job of organizing, printing and binding.

Conn, Howard, F., Editor, 1954 Current Therapy, [Philadelphia and London: W. B. Saunders Company, Pp. 898, 1954. $11.00.]

This is a large comprehensive volume affording methods of treatment for nearly every disease that the physician meets in his practice. The present edition is the sixth of an annual series that has been outstanding in its editorial staff, its selection of contributors and in its comprehensive covering of the material presented. The methods advised are up to date in contents with many additions supplied by the 192 new contributors.

One could select several of the articles as particularly complete and informative. "Pul-

monary tuberculosis", the "Cardiac arrhythmias" and "Peptic ulcer" are among these. The section on the nervous system comprises over 80 pages and covers 38 topics of value to the specialist in this field. It is thoroughly indexed and will continue to serve as a reliable reference source for the busy doctor. Every physician should keep himself supplied with the latest copy in the Series.

Overholser, Winfred, THE PSYCHIATRIST AND THE LAWS [New York: Harcourt, Brace and Co. Pp. 147, 1953. $3.50.]

The American Psychiatric Association established the Isaac Ray Award in 1952 in memory of this outstanding American psychiatrist, who published in 1948 the first systematic treatsie on the relationship of psychiatry and the law. This award which is to be given annually for the most important "contributions to the improvement of the relations of Law and Psychiatry", was granted first to Dr. Winfred Overholser, Superintendent of St. Elizabeth's Hospital, Washington, D. C., whose many contributions to the subject are known to all interested in the field of forensic psychiatry.

This book is composed of the lectures given as part fulfillment of the terms of the award. The titles indicate clearly the contents of the text, I The Substance of Psychiatry; II Some Differences of Viewpoint; III The Mental Patient and the Hospital; IV The Psychiatrist as Witness. Dr. Overholser has presented with literary skill and rare comprehensiveness the many problems that beset this important field and from his extensive experience he has here given psychiatrists, lawyers, teachers, students and the general public an invaluable body of information concerning historical and modern viewpoints, as well as a wealth of suggestions for progressive correction of certain existing errors of thinking and practice. It will enrich any library and merits a place of prominence in our psychiatric and medico-legal literature.

BOOK REVIEWS

Schneck, Jerome M., STUDIES IN SCIENTIFIC HYPNOSIS. [New York: Nervous and Mental Disease Monograph, 1954. Pp. xvi + 333. $6.50.]

This volume is made up of selected writings by the author whose major recent field of study has primarily been research in hypnosis. There are several new items presented for the first time, but the bulk of this volume has previously appeared as separate papers in the literature.

The original material has not been dressed up or changed in any way, but follow-up data and new opinion have been added where necessary. The author is well-known for his symposia on the subject and his text published in 1953. He has also included an appendix listing of all his titles in this field.

The organization of the book has been into areas which the author felt would be of most use to professional workers, and begins with a discussion of hypnotherapy and hypnoanalysis. General theory is followed by a discussion of cases primarily psychoneurotic in nature, including phobias, automatic writings, amnesia, cardiovascular reactions and military first aid. In this section the author also has considerable material on special research aspects such as homosexual problems, relationships of hypnoanalysis to the Thematic Apperception Test and dreams.

He concludes this part with a critical evaluation in which he points out that hypnotherapy is applicable to a wide variety of approaches in psychotherapy. He feels that symptom removal can be attempted without developing insight, and that psychological functioning may be studied depending on the specific problem. He also indicates that hypnotherapy may be used to uproot important buried memories or it may be simply supportive or, again, may attempt reconstruction dependent on knowledge of psychodynamics. Advances of such therapy are emphasized by stressing that hypnotherapy is a supplement to and a modification of other methods. As a technique to increase productivity, undercut resistances, develop transferences and diminish treatment time, the technique is of great use. The author rightly stresses that entertainment hypnosis and gen-

eral professional misinformation increase the therapists' difficulty.

The second part of the book deals with hypnotic induction studies, phenomena, theory and special explorations. This part represents complex research results, and is particularly interesting. Psychosomatic reactions to the induction of hypnosis involving respiratory, cardiovascular and gastrointestinal symptoms are discussed. Miniature conversion reactions developing during induction are presented and there is an excellent discussion of the potential problems of criminal behavior possibly resulting from posthypnotic suggestion. This particular area is extraordinarily complex, and the author presents a case of a soldier who committed a military offense during hypnotic sessions. The author rightly feels that this entire subject needs reevaluation.

Problems of audiometry under hypnosis are also developed, and there is a fairly long discussion on the relationship between hypnosis and death. Notes on spontaneous hallucinations, use of the technique for exploration in vocational areas, self-hypnosis in obstetrics and investigation of hypnotic dreams are also intriguing.

The last section of the book deals with a discussion of cultural and historical aspects of hypnosis, taking up certain phases in the historical development of the French school, including the school of the Hospital de la Charité. The case of M. Valdemar as described by Poe is discussed and there is also a short note on Mesmerism in Henry James' *The Bostonians* and a fairly long discussion of Du Maurier's *Trilby*. An index, and an excellent table of contents complete the usefulness of this work.

As a research contribution this book is of real value. The organization so far as it goes is good, and oddly enough, the not-too-complete relatedness of the papers permits assimilation of the ideas presented without the burden of carrying forward data previously read. Most collected works are unduly scattered in content, but in this one the author has arranged the papers so the general development of the reader is encouraged in spite of the fact that there is lack of relation in spots. The volume has been written for advanced students and individuals who are really concerned with working in this field. For this group it will prove stimulating, provocative and should encourage future research.

DOUGLAS M. KELLEY.

Germer, W. D., VIRUSERKRANKUNGEN DES MENSCHEN: EIN LEHRBUCH DER KLINIK EPIDEMIOLOGIE UND ATIOLOGIE DER MENSCHLICHEN VIROSEN: [Stuttgart: Georg Thieme Verlag: Pp. 190 with 47 illustrations (8 in colors) 1954. D.M. 30—]

The author of this contribution to medical literature is chief physician in the Medical Clinic and Docent in the University of Tubingen. The subject matter is presented in four parts, and a preface by Prof. Dr. H. Bennhold.

Following the Introduction which constitutes part one, the second part deals with the general concepts of virus formation and with methods of investigation and isolation of these bodies including the procedures involving the ultracentrifuge, the flourescent microscope, the electron microscope and chicken embryo techniques.

The third or special and most extensive part presents the various virus diseases according to the bodily systems involved. Relative to the respiratory tract there are acute coryza, mumps, forms of infiuenza, primary atypical pneumonia (acute pneumonitis), and psittacosis and ornithosis. Under the exanthemata are measles, chicken pox, herpes zoster, German measles, nononucleosis infectiosa, small pox, dengue fever and san-fiy fever. In connection with the small pox section, protective vaccination and its various problems are discussed. This section on exanthemata is illustrated by excellent pictures of skin in colors.

Under virus diseases of the liver one finds infections hepatitis and yellow fever and under the central nervous system there are poliomyelitis, the group of anthropod transmitted virus encephalitides as encountered in America, Japan, Urasia and Africa, lymphocytic choriomeningitis, encephalomyocarditis and rabies. Virus diseases of the musculature is described under the term "coxsackie virus" are represented by lymphogranuloma inguinale the virus lymphadenitis often called "cats scratch disease."

Virus diseases of the eyes such as trachoma, kerato-conjunctivitis epidemica and inclusion

conjunctivitis and finally the virus caused disorders of the skin including molluscum contagiosum (epithelioma contagiosum of Neisser) verrucae and herpes simplex in its several forms and symptoms.

The fourth and last part or appendix of the book is devoted to useful tables listing incubation, isolation, and quarantine periods for the virus disorders, outlining methods and tissue selections for laboratory diagnosis, and giving a section on tissue staining methods.

Each one of the disorders included is described systematically as to synonyms, definition, historical orientation, etiology, epidemiology, clinical expression, pathology, therapy and laboratory diagnosis. The book is excellently printed on superior paper, the illustrations are clear cut, it is well documented with pertinent references at the end of each topic and is adequately indexed. It will be a valuable book for the neurologist as well as for the internist.

Callewaert, H., GRAPHOLOGIE ET PHYSIOLOGIE DE L'ECRITURE. [E. Nauwelaerts, Louvain, Belgium. 1954. Pp. 168 and 31 pp or reproductions. $1.80.]

The author, a Belgian neurophysiologist, has been actively interested in graphology for about twenty years. His previous publications are noteworthy mainly because they dealt with the little known and very little studied problem of the physics and physiology of writing. He filmed hands in the process of writing under various conditions, changing the writing equipment and the holding of the pen. The exact record of the movements of the hand related to the quality of writing convinced the author that the holding of the pen is by far the most important factor determining handwriting which consequently cannot be a means of personality analysis. In the present little volume, clear in its exposition and spirited in its polemics, the question is discussed whether any emotional or character traits can be detected in handwriting. Also the "laws of graphology" are subjected to critical analysis. The author finds that graphologists disagree among themselves and that their claims have no scientific foundation. He concludes that the influence of personality upon handwriting has been greatly exaggerated but he admits that certain inferences can be made reliably. Handwriting as an expression of personality can be compared, to use the author's words, to spoken words transmitted by a loudspeaker with the omission of such important cues as the facial expression, manual and other gestures, of intonation, and of accent. The basic error of graphology is said to consist of assuming that the writing movements are expressive gestures. The latter, if free and spontaneous, could be thought of as direct or indirect (symbolic) indicators of feelings and intended actions. However writing is an extremely complex motor activity, which is acquired relatively late and is imposed upon the individual by the civilization in which he lives; it is a standardized procedure since the letters are conventional and its purpose is to express thoughts. Furthermore, handwriting is acquired with difficulty and at a slow pace; it is never perfect and tends to be quite fixed. The author does not raise the question whether the different ways of holding a pen are not influenced by specific personality traits. Thus the graphologists might say that his criticism are not as devastating as they appear. Nevertheless, the author has demonstrated very well the serious limitations of graphology as a method of personality investigation: he showed the effects of neuromuscular and physiological factors to be so great that the effects of enduring and specific personality traits are small and unreliable by comparison. Dr. Callewaert's challenge is trenchant and relevant. It can help graphologists to avoid fruitless investigations and concentrate on what graphology can contribute. The author's valuable volume is of interest also to educators for he discusses the defects of teaching handwriting and points out ways to remedy them.

Z. A. PIOTROWSKI.

Piaget, Jean. THE CONSTRUCTION OF REALITY IN THE CHILD. [Basic Books, Inc., New York. 1954. Pp. xiii + 386. $6.00]

This is a translation of a known and basic book on the development of orientation in reality and of thinking during the first eighteen months of life. The author, a distinguished Swiss psychologist, has the capacity to relate the most abstract questions of philosophy (the origins of the concepts of time, space, casuality,

or the influence of activity upon the knowledge of the world) with minute and precise observations of the infant's behavior. Thus, small observations bear rich fruit because they are interpreted in the light of a well thoughtout and very important logical scheme of concepts and basic principles. At the same time, concrete observations are clearly separated from the process of interpretation to which Piaget has subjected them. The reader is able to follow easily the recording of the data and the stages of interpretation. Facts and interpretation are separated even by the difference in the type of print. Many observations are based on Piaget's original, simple, and relevant experiments.

The results will probably be corrected in some details by other investigators. Piaget's subjects were his own two bright children. It is hard to imagine that all observations made on two children can be typical of all children. However, the chief results, the process of growth of the infant's concept of reality, and particularly the procedure, in its logical as well as technical aspects, will remain permanent contributions in a very difficult field. One of the main obstacles in the psychological study of infants, especially of their sensor-motor and cognitive processes, is the difficulty in establishing a satisfactory rapport with the infant. This serious difficulty was obviated by Piaget since his own children were his subjects. Earnest, patient, and penetrating psychological analyses of thinking are quite rare nowadays which enhances the value of Piaget's remarkable work.

The translation was done by Margaret Cook and is excellent.

Z. A. PIOTROWSKI

Lewis, Nolan, D. C. and Engle, Bernice, Editors. WARTIME PSYCHIATRY. A Compendium of the International Literature. [Oxford University Press, New York. 1954. Pp. vii + 952. $15.00]

This large book offers summaries of about 1300 articles and books which appeared in the nine years from 1940 to 1948. The selections depended on the relevance to wartime problems and the use of large numbers of cases for the sake of reliability; however individual cases of special interest consisting of unusual symptoms, some novel treatment of the case, or unexpected results, also were reviewed. In addition to the summaries there are about 200 "additional references", most of which contain a one to three sentence abstract. The material is divided into 14 sections, examples of which are: psychosomatic problems, psychoses, special therapies, problems of combat, problems of demobilization and rehabilitation, lessons to be learned, etc. The greatest majority of the material reviewed was published in the United States, much of it in Great Britain, and some in other countries.

The editors undertook this enormous task with the hope to aid the organization and use of knowledge in the diagnosis, treatment, and prevention of psychiatric disabilities contingent upon wartime conditions in military and civilian life. Past experience has shown that psychiatric disabilities constituted more than half of all disabilities and that they were by far the most important single cause of manpower shortage. The material surveyed consists almost exclusively of descriptions of observations, or "raw data" which of course are not always sufficiently complete for theoretical evaluation. The theoretical implications of wartime psychiatric and psychological experiences are great and have not been fully appreciated. One significant theoretical problem pertains to the hierarchy of instincts. Which of the instincts or drives possesses the strongest influence upon conduct? Is it gratification of sexual needs, of hunger, or of the desire to avoid death at the hands of others which dominates the human being most effectively? What are the conditions in which the hierarchy of these instincts changes? Another problem is whether the neurotic ways in trying to handle an instintual problem are the same regardless of the nature of the instinct. This book's rich material prompts one to ask many a question. The material is abstracted in such a manner that it lost nothing of its continuity and reads easily. The book amounts to an encyclopedia which is indispensable to anyone interested in wartime psychiatry.

Z. A. PIOTROWSKI

Zilboorg, Gregory: THE PSYCHOLOGY OF THE CRIMINAL ACT AND PUNISHMENT. [New York: Harcourt, Brace and Company, 1954. Pp. xi + 141. $3.50]

In 1838, at the age of 31, Isaac Ray, a great

American psychiatrist complained eloquently and convincinly in his book on medical jurisprudence of insanity that "the condition of the law relative to insanity is behind our present knowledge concerning that disease". Dr. Zilboorg, second recipient of the Isaac Ray award established by the American Psychiatric Association, shows that in the second half of the XXth century the law is still far beyond our knowledge of mental illness. He describes the plight of the psychiatric expert in court, the fundamental differences between psychiatric and legal thinking about responsibility, the great difficulty in establishing whether the offender was or was not able to control (suppress) his impulse, the failure of punishment to deter others from committing crimes, and various aspects of the interrelationship between psychiatrists, lawyers, judges, and juries. The author suggests that the misunderstanding between the psychiatric and the legal professions might be materially reduced if the training of law students were made similar to that of medical students, if, in other words, "clinical training" were part of the legal education and law students visited jails, served as prison guards for a while, attended many executions, collected authentic case histories from various prisoners themselves and compared them with the prisoner's official record, opinions of parole officers, etc. Dr. Zilboorg advocates that the psychiatrist be a real expert, not an expert only for the prosecutor or only for the defense, and that he be given the right to refuse answers to questions he cannot answer either because they make no psychological sense involving moral value judgments or because there is no reliable evidence on which to base an adequate response. The discussion is always lively and is placed well into a historical frame.

The author makes many cogent and refreshing remarks, such as, e.g., "that the older concepts of quick justice have long outlived their usefulness". He points out that a careful study of the criminal's total personality is needed to understand the motives for the crime. The book is weakest in dealing with the most difficult problem of criminology: the theory of crime. This is treated on but few pages. The explanation is given in terms of repressed aggression (hostility) which leads to the development of a severe feeling of guilt; and which, in turn, prompts punishable crimes. This theory is patently inadequate for the number of people with repressed aggression as the author defines aggression (he makes it synonymous with "a special instinctual desire, an ingredient of everything that is good as well as evil in our behavior", with self-assertion, initiative, creativeness) is by far larger than the number of criminals and suicides. The possibility that one essential factor in crime may be the inability to evaluate reality adequately and to "control" one's actions because of a severe illness (e.g., a psychosis) which is independent in its origin from psychosocial motivation, repressed assertiveness, etc., is not mentioned. The author blames chiefly "the impulse to take revenge" for the unwillingness of the legal profession and of society at large to treat crime scientifically. Isaac Ray said that the XXth century would have a scientific approach to crime; Zilboorg postpones it until the XXIst century.

The purpose of the Ray award lectures is to improve the relations of law and psychiatry. Dr. Zilboorg has not only discussed frankly some reasons for the imperfect state of these relations, but he has suggested some practical steps which, if taken, would improve the relations and subsequently our understanding of criminal behavior.

Z. A. PIOTROWSKI

BOOKS RECEIVED FOR REVIEW

1. BERNARD, J. AND JENSEN, D. M. *Sociology.* The C. V. Mosby Co., St. Louis, Missouri.
2. DEMERRE, L. J. *The Female Sex Hormones.* Vantage Press, Inc., N. Y., N. Y.
3. EIDELBERG, L. *A Comparative Pathology of the Neuroses,* International Univ. Press, N. Y., N. Y.
4. FAIRBAIRN, W. R. D. *An Object-Relations Theory of the Personality.* Basic Books, Inc., N. Y., N. Y.
5. GILLILAN, L. A. *Clinical Aspects of the Autonomic Nervous System.* Little, Brown & Co., Boston, Mass.
6. HELHOLTZ, H. *On the Sensation of Tone.* Dover Publications, N. Y., N. Y.

7. KAPPER, M. *Basic Concepts in Community Planning for the Cerebral Palsied.* United Cerebral Palsy of N. Y. C., Inc., N. Y., N. Y.
8. KUTASH, S. B. AND GEHL, R. H. *The Graphomotor Projection Technique.* Charles C. Thomas, Springfield, Ill.
9. *Annual Report of the Board of Regents of the Smithsonian Institution.* Smithsonian Institute.
10. STANTON, W. H. AND SCHWARTZ, M. S. *The Mental Hospital,* Basic Books, Inc., N. Y., N. Y.
11. WEISS, M. O. *Attitudes in Psychiatric Nursing Care.* G. P. Putnam's Sons, N. Y., N. Y.

Obituary

Charles Irwin Lambert, M.D.

(1878-1954)

Dr. Charles I. Lambert, well known New York psychiatrist, died at Casablanca, Morocco on April 18th from a coronary thrombosis at the age of 78 years. Born in Argyle, Wisconsin, the son of the late Furniss and Mary Wesley Reynolds Lambert, he attended State Teachers College in Iowa and later received his medical degree from the State University of Iowa Medical School in 1903. He did postgraduate work at Harvard and Munich.

From 1905 to 1913 he devoted himself to neuropathology and was assistant in that department at the New York State Psychiatric Institute on Ward's Island and pathologist at the Manhattan State Hospital. From 1913 to 1922 he served as assistant director of Bloomingdale Hospital at White Plains, New York. He next became associated with Columbia University where for many years he was Professor of Psychiatric Education at Teachers College and an associate in Psychiatry at the College of Physicians and Surgeons. He directed the psychiatric department of the Vanderbilt Clinic from 1922 to 1928.

Dr. Lambert served as psychiatrist in the draft service during both World Wars, and was a member of many scientific and clinical societies. He was a careful worker, sound thinker and excellent teacher whose presence among his professional and personal friends will be sadly missed.

An announcement has been made of the death of Dr. Laignel-Lavastine of Paris at the age of 78 years. He came from a family of physicians, and a granduncle Jacques Dariel, an ophthalmologist, devised a cataract extraction operation. Laignel-Lavastine was interested in many areas of medicine and science. An exceptionally proliferic writer he published articles and books on psychiatry, history of medicine, endocrinology and on the sympathetic nervous system. In 1910 he was appointed associate professor of medicine at the Paris Faculty of Medicine, professor of medicine in 1931, and professor of psychiatry in 1939. He was a member of the Academy of Medicine, a founder and president of the French Society of History of Medicine and president of the International Society of History of Medicine.

Many readers will remember the English translation of his work, on the Internal Secretions and the Nervous System, which appeared in the Nervous and Mental Disease Monograph Series in 1919.

NOTES AND NEWS

THE ACADEMY OF PSYCHOSOMATIC MEDICINE

The Academy of Psychosomatic Medicine held its first Annual Meeting at the Plaza Hotel, New York City, on October 8-9, 1954. Over one hundred Fellows and guests attended the two day session, devoted to THE PSYCHOSOMATIC ASPECTS OF SURGERY.

The speakers included, among others, Drs. E. A. Rovenstine, Charles P. Bailey, William S. Kroger, Lester L. Coleman, T. F. Schlaegel, Jr., Arthur J. Barsky, C. D. Haagensen, and John A. P. Millet. A panel discussion on "What Every Physician Should Know About the Psychosomatic Aspects of Surgery" was moderated by Dr. Herbert Conway, the members of the panel being: John M. Cavanagh, Samuel P. Harbison, Albert S. Lyons, John A. P. Millet, Harold Rosen, and Somers Sturgis. Plans are being made to publish the papers in book form.

The Society voted to extend the present incumbents in office for an additional year. For President, Dr. William Kaufman, Bridgeport, Connecticut; for Vice President, Dr. Bernard B. Raginsky, Montreal, Canada; for Secretary, Dr. Ethan Allan Brown, Boston, Massachusetts; for Treasurer, Dr. Alfred J. Cantor, Flushing, New York, and for Historian, Dr. Robert S. Drews, Detroit, Michigan.

The second annual meeting will be held again at the Hotel Plaza, October 6th, 7th and 8th, 1955. The general subject decided upon is THE PSYCHOSOMATIC ASPECTS OF DRUG ADMINISTRATION. Those who wish to present papers at this meeting are invited to communicate with the program Chairman, Dr. Ethan Allan Brown, Boston, Massachusetts, from whom applications for Fellowship and a copy of the Constitution may also be obtained.

The third annual meeting is planned for the Edgewater Beach Hotel in Chicago, in October 1956. The program Chairman will be Dr. William Kaufman, and the subject tentatively chosen is THE PSYCHOSOMATIC ASPECTS OF ENDOCRINE DISORDERS.

NATIONAL FOUNDATION FELLOWSHIPS

The National Foundation for Infantile Paralysis announces the availability of a limited number of postdoctoral fellowships in medicine and the related biological sciences.

These fellowships are awarded as a part of the National Foundation's program of professional education for which more than $19,000,000 in March of Dimes funds have been appropriated since 1938.

These fellowships are offered to candidates who are preparing for careers in scientific research and/or academic medicine. They are not awarded to investigators for the support of a research project. Special consideration will be given to applicants interested in such fields as: microbiology, biochemistry, biophysics, orthopedics, pediatrics, neurology and epidemiology.

Eligibility requirements include: an M.D., Ph.D., or equivalent degree, U. S. citizenship (or application for citizenship) and sound health.

Selection of candidates will be made on a competitive basis by the National Foundation's Fellowship Committee. Fellowships will be awarded for a period of one to three years and in rare instances may be extended to five years.

Stipends ranging from $3,600 to $7,000 a year are allowed, the specific sum being determined by marital status and number of dependents. The institution in which the Fellow receives his training may request compensation of $500 to $1,000 a year.

For consideration by the Fellowship Committee in February, applications must be received by December 1; for consideration in May, applications must be filed by March 1; for consideration in November, by September 1.

For further information and application blanks address: The National Foundation for Infantile Paralysis, Division of Professional Education, 120 Broadway, New York 5, N. Y.

G.A.P. REPORT NO. 27

The readers of this Journal will be interested in a publication just announced by the Group for the Advancement of Psychiatry entitled, "Integration and Conflict in Family Behavior," GAP Report No. 27.

This report is the first of a series being prepared by the Committee on the Family on the relation between the family and the mental health or illness of the individual. The general question being asked in all the reports is whether one can distinguish various states or conditions in the family which are either hostile to or promote the healthy adjustment of the individual. This first report proposes a method for dealing with this question. The method consists of defining the social roles of the members of the family in accordance with the values arising from the cultural background of the family. So defined, the roles are then matched and analyzed for the degree of integration or conflict which inheres in them. In this way, family problems can be related rather precisely to cultural conflicts on the one hand, and to the emotional problems of the individual on the other.

The Group for the Advancement of Psychiatry has a membership of approximately 150 psychiatrists, organized in the form of a number of working committees of about 10 members each, which direct their efforts toward the study of various aspects of psychiatry and toward the application of this knowledge to the fields of mental health and human relations. GAP is an independent group and its Reports represent the composite findings and opinions of its members only, guided by its many consultants. Collaboration with specialists in other disciplines has been and is one of GAP's working principles.

Copies of GAP Report No. 27 may be obtained by writing to the Group for the Advancement of Psychiatry, 3617 West 6th Avenue, Topeka, Kansas, and enclosing fifty cents.

BRONX SELECTED AS LOCATION FOR NEW MENTAL INSTITUTION

First Hospital to Be Constructed Since End of World War II; Will Contain 4,000 Beds

Selection of a site in The Bronx for the first completely new mental institution in New York State since the end of World War II was announced by Governor Thomas E. Dewey in July.

The 4,000-bed, $45,000,000 facility will, in effect, be part of a huge medical center including the East Bronx Central Hospital and the Albert Einstein College of Medicine of Yeshiva University.

The 124-acre site for the new mental hospital lies along the west side of the Hutchinson River Parkway, extending south from its intersection with Bronx and Pelham Parkway, in the Pelham Bay Park area of The Bronx.

THE INTERAMERICAN SOCIETY OF PSYCHOLOGY

The Second Annual Congress of the Interamerican Society of Psychology was held at the new University City of Mexico from December 14 to 19, 1954.

The central theme was *Psychology of Education,* from the aspects of Applied Psychology, Psychotherapy, Social Anthropology and Teaching.

MASSACHUSETTS SOCIETY FOR RESEARCH IN PSYCHIATRY

The following are the newly elected officers of the Massachusetts Society for Research in Psychiatry for the year 1954/55:

President: Rudolph Kaldeck, M. D.

Vice-President: Daniel H. Funkenstein, M. D.

Secretary-Treasurer: Mar Rinkel, M. D.

Chairmen of Committees:

Executive Committee: Milton Greenblatt, M. D.

Program Committee: Phillip Solomon, M. D.

Publication Committee: John Mackenzie, M. D.

Membership Committee: Morris Sharp, M. D.

Committee on Constitution: Myer Askoff, M. D.

The schedule of the meetings of this Society is as follows:

Wednesday, October 27, 1954—(First Meeting)

Wednesday, December 1, 1954—(Second Meeting)

Friday, February 4, 1955—(Third Meeting)

Friday, April 8, 1955—(Fourth Meeting)

DR. RICHARD BINZLEY APPOINTED ASSISTANT COMMISSIONER OF MENTAL HYGIENE

Appointment of Dr. Richard F. Binzley as Assistant Commissioner of Mental Hygiene was announced Sept. 24th by Dr. Newton Bigelow, Commissioner. Dr. Binzley will fill the post left vacant by Dr. Robert C. Hunt, who was recently named to head the department's new Community Mental Health Service. The new appointment becomes effective October 1, 1954.

In addition to his new duties as assistant commissioner, Dr. Binzley will carry on at Syracuse Psychopathic Hospital as acting director. Before his appointment, Dr. Binzley was director of the Syracuse institution. Dr. Binzley joined the department in 1933 after serving two years as resident psychiatrist at Grasslands Hospital in Valhalla, N. Y. That same year he was appointed assistant physician at Pilgrim State Hospital, West Brentwood, L. I., and subsequently progressed to the position of associate director in January, 1951.